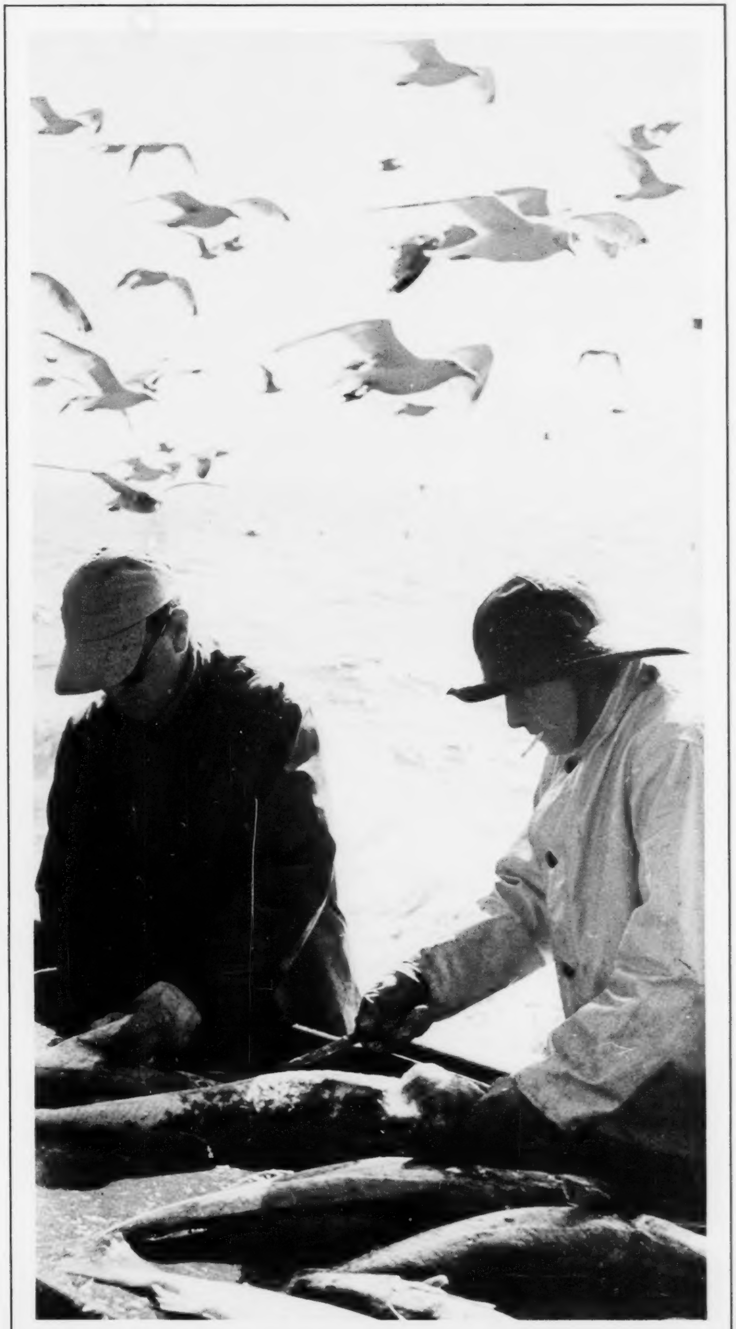
Volume 39 Number 2 February 1977

Marine Fisheries REVIEW

National Oceanic and Atmospheric Administration • National Marine Fisheries Service



Advances in New England Fisheries

U.S. DEPARTMENT OF COMMERCE
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Marine Fisheries Review is published monthly by NMFS Scientific Publications Staff, Room 450, 1107 N.E. 45th St., Seattle, WA 98105.

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director, Office of Management and Budget, through May 31, 1978.

Editor: J. D. Harrell
Managing Editor: W. Hobart

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price $1.10 (single copy). Subscription price: $12.75 a year, $15.95 a year for foreign mailing. Controlled circulation postage paid at Seattle, Wash.

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Fisheries Development in New England—A Perspective

W. F. RATHJEN

INTRODUCTION

Since 1973, interest and activity in "fisheries development" has accelerated rapidly both at the regional level throughout the United States and internationally. The reasons for this are multiple and complex. Fisheries Development activities are correspondingly broad and involve a variety of disciplines culminating in utilization. Some of the primary factors influencing use of latent or underdeveloped resources (by U.S. interests) include:

1) Availability of traditional resources reduced.
2) Economic inability to take advantage of available technology (harvesting, handling, processing).
3) Competition in the marketplace with imported fisheries products and innovative foods replacing "traditional" products.

Recognizing the points indicated as basic, it is evident that they all reflect transitory situations and presumably corrections will develop as political and social adjustments are evolved. Some real possibilities exist, however, in smoothing transitions through coordinated efforts—this area is the focus of fisheries development.

This coordination was formalized in New England in 1973 by the establishment of the "New England Fisheries Development Program" (Rathjen, 1974). The activities conducted under it, some of the results, and the possibilities for future emphasis, are the focus of this review.

SCOPE AND ORGANIZATION OF EFFORT

The primary direction of the initial program was derived by an assimilation of existing information and interpretations by industry, academic, and State and Federal fisheries participants. The original concept involved the following primary ingredients: 1) Industry input and review of direction. 2) Contributions from existing entities throughout the fisheries spectrum to include, but not be limited to: Existing NMFS, State, and Sea Grant program activities, particularly resource assessment, harvesting and processing technology, and marketing.

Several important criteria were used to assist in the selection of candidate species, including availability, markets, and industry interest.

Availability

Due to the severe depletion and continuing competition for many "traditional stocks" (i.e., haddock, flatfish, ocean perch, and lobster), primary effort was to be devoted toward species either completely under utilized, such as red crab (*Geryon quinquedens*) or with probable slack between the stocks available (sustainable yield) and the actual use such as the squids. A third classification included species heavily exploited by foreign fishermen but only of marginal interest to U.S. fishermen (herring, mackerel, and trawl discards collectively called mixed species).

Markets

All candidate species were considered in terms of their ultimate marketability and value either in domestic markets real or projected or for the possibility of export.

Industry Interest

As industry participation in the selection process was viewed as the most important factor, this category was weighed heavily. In particular, adaptability of existing harvest and processing techniques as well as marketing links were considered.

After careful consideration of the above factors, three primary groups were considered: Squids (long-finned squid, *Loligo pealei*; short-finned squid, *Illex illecebrosus*); Offshore crabs (red crab, *Geryon quinquedens*; Jonah crab, *Cancer borealis*; rock crab, *Cancer irroratus*); mixed species—trawl fish discards (whiting, *Merluccius bilinearis*; red hake, *Urophycis chuss*; ocean pout, *Macrozoarces americanus*; herring, *Clupea harengus* and mackerel, *Scomber scombrus*, Figure 1; and others).

WHAT'S BEEN DONE

Squids

Harvesting

Harvesting experiments have been sponsored by the program using a number of techniques which have included development of high opening bottom trawls, demonstration fishing, with bottom trawls, two boat trawls, and experimental light attraction. Some of these experiments are reviewed in another article in this issue (Taber, 1977).

Holding

In conjunction with some of the harvest experiments, controlled studies of preservation techniques have been underway. These have included holding in ice with varying ratios, holding in chilled seawater, and freezing tests. Although testing and experimentation is still incomplete, preliminary findings indicate that holding in ice for 5 days or longer is practical and that the use of chilled seawater is very attractive for preservation of fresh squid.

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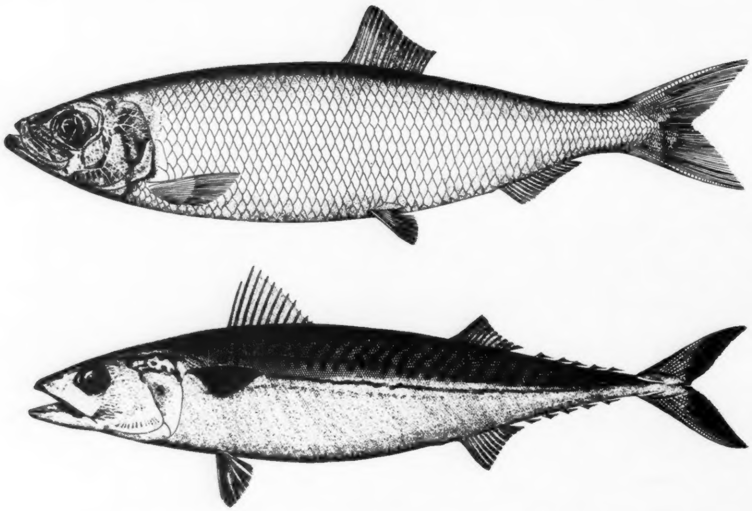

Figure 1.—The herring (above) has long been of interest to U.S. fishermen and has gained new significance during recent years. Export markets in Europe are becoming increasingly attractive to U.S. processors. The mackerel (below) has supported variable interest in U.S. fisheries effort in the past. This resource is currently abundant and with suitable market opportunities could again support a substantial fishery.

Processing

A number of starts have been made which have directed research to mechanically sorting and processing of squid, which is producing cleaned mantles, strips, or rings. These are of interest to some domestic users. Basic research on the potential of squid as a canned product has also been contracted for.

Marketing

It is evident that many opportunities for export of squid exist, particularly in southern Europe and the Far East. Potential use of squid in domestic markets is somewhat less certain. In the case of the former, market studies and preliminary contacts have been established throughout western Europe. Domestic markets have been addressed somewhat superficially through the development and distribution of consumer materials like recipe books (Fig. 2) and posters. This has been supplemented by media presentations which include squid and other underutilized species. More recently a carefully planned study designed to establish a market posture has been started. There is some reason to project that markets for up to 25,000 tons may be a realistic goal within the next 5 years.

The Resource

Demonstration fishing was conducted to measure the density, size, and sex composition of red crab stocks. A limited tagging program was carried out to develop a sensitivity to local movements and frequency of moulting. Measurements of commercial catches were made and the industry was supported with technical input in early efforts to maintain crabs alive aboard vessels. The resource base was examined in a number of dimensions by NMFS research biologists. Coordinated surveys of existing fishery intelligence were conducted on Jonah and rock crabs. These included the crabs from western Maine to the Connecticut border.

Processing

A number of meat extraction processes have been conducted experimentally for red, rock, and Jonah crabs. Adaptation of roller extraction equipment developed for Alaskan species has been successfully demonstrated and adapted to limited commercial operations in New Bedford and Gloucester, Mass. (Fig. 3).

Roller extraction of meat from rock and Jonah crabs is also proceeding experimentally. Some program supported studies on the three crab species have also been conducted on storage life, packaging, cooking, and development of product forms.

Marketing

The experience accrued by NMFS processing technologists has been cooperatively demonstrated in industrial processing applications at more than three locations in New England (and beyond). As a result, there are currently several operations producing a variety of products from the three target crab species. These products include whole cooked crab, cocktail claws, mechanically processed meat, canned products, and specialized products. To a substantial degree, the future for these products will probably be determined during the next several years. The ability to compete with blue crab, king crab, and other species is being tested in the crucible of the marketplace.

Mixed Species

This category is the most complex of the objective groupings. In spite of the challenges, it offers the greatest potential to the industry. Some aspects of our orientation are included here.

The Resource

In terms of volume, the most outstanding species included are whiting, red hake, mackerel, and herring, any

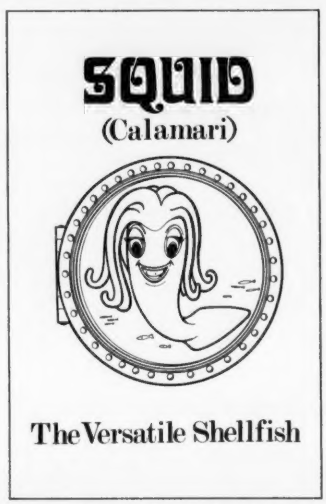

Figure 2.—The squid recipe booklet, one of several promotional aids used to encourage domestic interest in the utilization of squid.

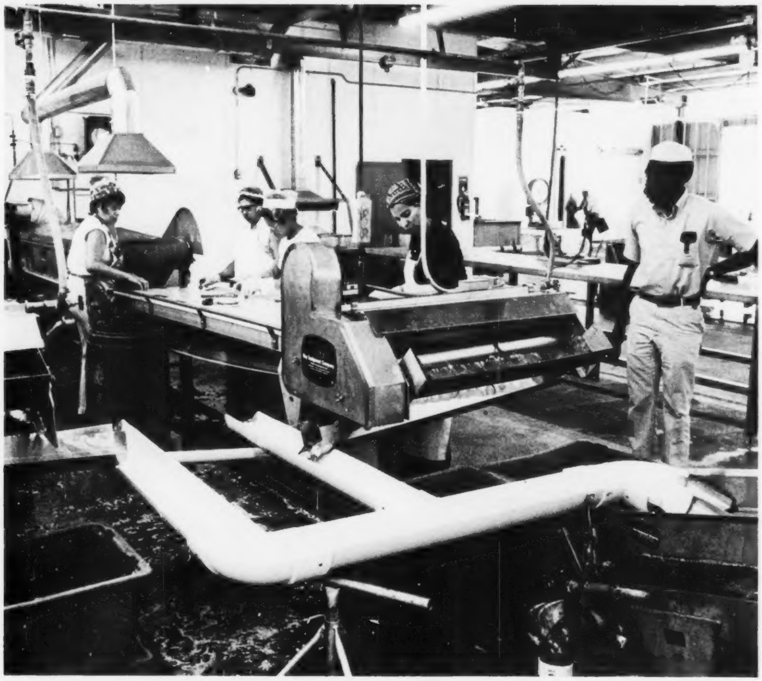

Figure 3.—An NMFS processing specialist oversees the adaptation of mechanical meat separation equipment at a red crab processing facility in New Bedford, Massachusetts.

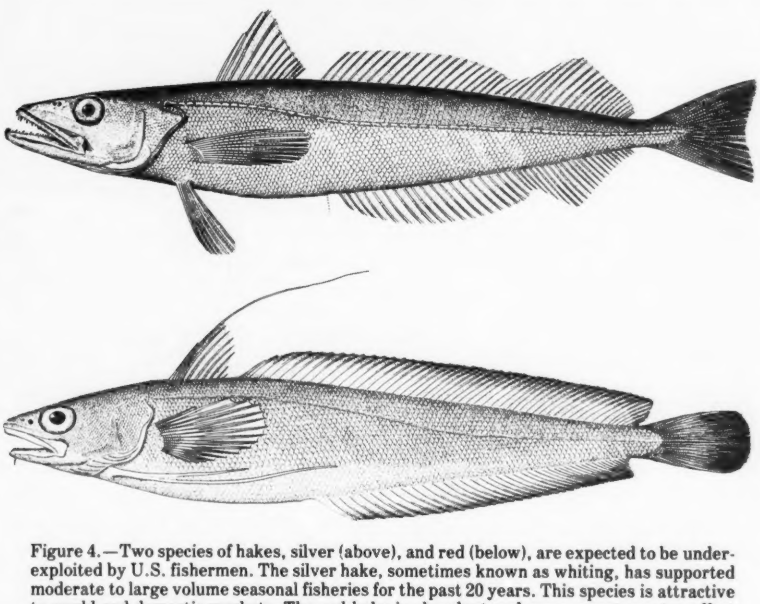

Figure 4.—Two species of hakes, silver (above), and red (below), are expected to be underexploited by U.S. fishermen. The silver hake, sometimes known as whiting, has supported moderate to large volume seasonal fisheries for the past 20 years. This species is attractive to world and domestic markets. The red hake is abundant and can support greater effort by domestic fishermen. Products and marketability are unanswered questions.

of which in a given year might be available in considerable tonnage. As a result of foreign pressure, the condition of herring and mackerel stocks is questionable for at least the period through 1977. The supplies available to the U.S. fisherman are probably adequate for some moderate expansion assuming some effort is directed into offshore areas. Although there is only marginal interest (at this time) in mackerel, the resource has been under heavy exploitation by foreigners during recent years.

Whiting and red hake stocks (Fig. 4) appear to be in comparatively good condition according to biological surveys. Other species are also included under this heading, all of which have varying levels of availability and market interest. Some of these (Fig. 5) are ocean pout, skates, greyfish (dogfish), goosefish, and butterfish.

Handling at Sea

It was early recognized that one of the major problems in attempting exploitation of these species was handling large volumes with comparatively small crews and minimum expense. During 1974 and 1975, experiments were conducted with two separate situations, one for mixed-trawl discards out of Galilee, R.I., and one for herring in Gulf of Maine waters out of Gloucester, Massachusetts. Both tests employed seawater and ice or chilled seawater (CSW) as a coolant. The herring experiment has led to adaptation of the technique by a commercial operation (Fig. 6).

As part of the handling experiment, the problem of offloading large volumes of fish has been included in objectives. A pneumatic system was leased and demonstrated through the Program. Experiments were coordinated with the CSW holding tests mentioned. As a result of the demonstrations, several units of the equipment demonstrated have been acquired and are now employed by New England processors.

One of the links in the holding-unloading-preprocessing which remains to be demonstrated is sorting the "mixed" species into categories by size and variety. Prototype equipment to accomplish this is now being tested.

All of the elements indicated, namely holding, unloading, and sorting will be further evaluated and refined as industrial opportunities become available.

Processing

Once these large volumes of essentially low value fish become available in the processing plants, they are the objects of a growing technological ability for automated sorting processing. Mendelsohn et al. (1977) describes one

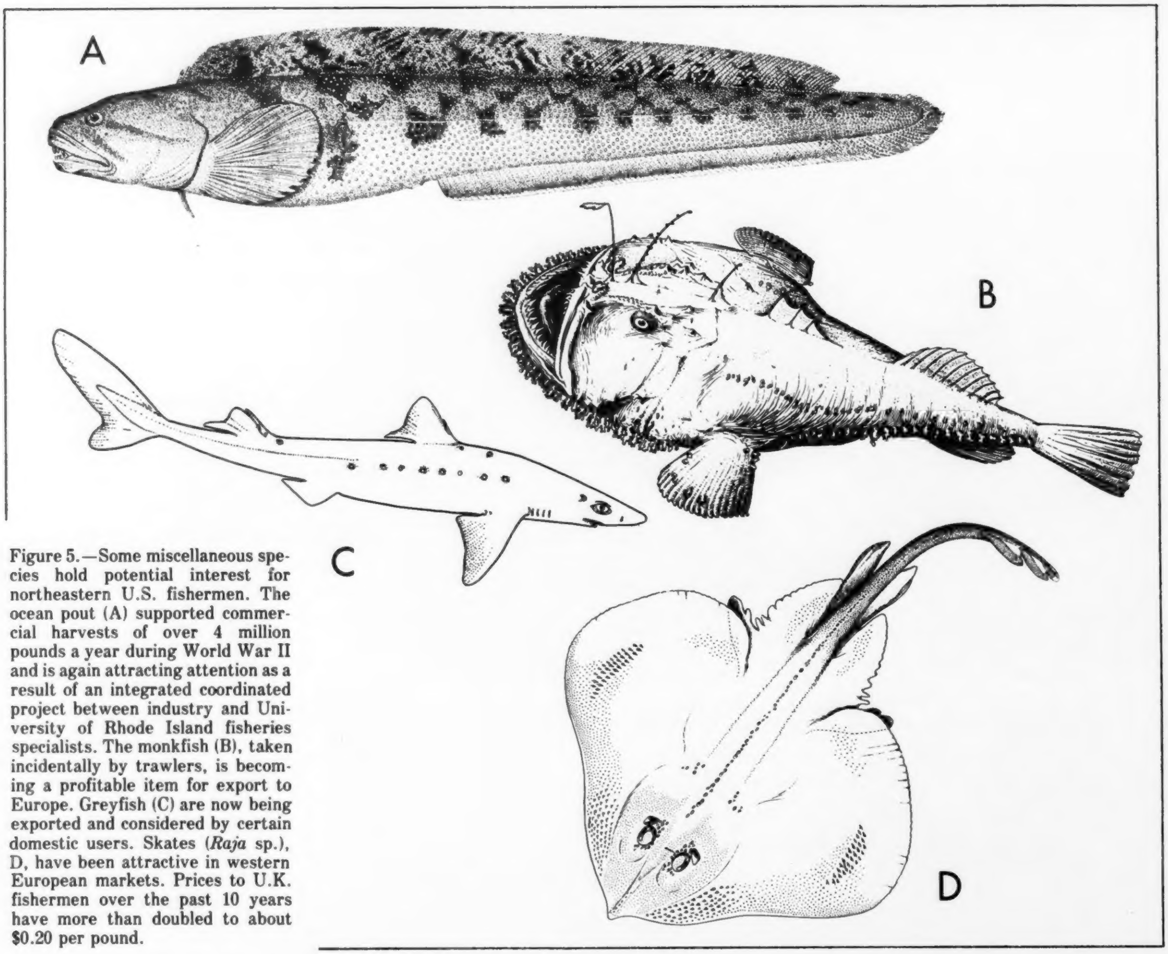

Figure 5.—Some miscellaneous species hold potential interest for northeastern U.S. fishermen. The ocean pout (A) supported commercial harvests of over 4 million pounds a year during World War II and is again attracting attention as a result of an integrated coordinated project between industry and University of Rhode Island fisheries specialists. The monkfish (B), taken incidentally by trawlers, is becoming a profitable item for export to Europe. Greyfish (C) are now being exported and considered by certain domestic users. Skates (*Raja* sp.), D, have been attractive in western European markets. Prices to U.K. fishermen over the past 10 years have more than doubled to about $0.20 per pound.

start supported by the program. Ultimate uses include the potential as a minced product, frozen fillets for export, and potential use as canned products.

Marketing

During the life of the program, substantial effort has gone forward under the general category of marketing mixed species. These efforts have included a survey of potential markets in western Europe for whiting, skates, and dogfish. Market demonstrations to evaluate the potential for domestic marketing of fresh and frozen herring fillets were undertaken in 1976. Consumer reactions were also sought relative to a "minced/salt-fish" product made from fish now discarded. Participation in overseas promotional efforts and continuing development of overseas market contacts is ongoing (McAvoy and Earl, 1977). Product development is going forward as an adjunct to the overall marketing effort.

The future emphasis in these areas will attempt to be responsive to reactions experienced. It is anticipated that the flow of fishery products will undergo some redirection during the next decade in response to changes in resources availability, political adjustments, and population growth.

Other Shellfish

Late in 1975, two new species areas were added to the list of objectives under the New England Fisheries Development Program. The blue mussel (*Mytilus edulis*) and ocean quahog (*Arctica islandica*) attracted program input. Although these activities are only recently underway, reduced or inadequate supplies of traditional species make these interesting to certain marketing situations.

Program supported activity on mussels is at this time concerned with the harvest of wild blue mussels available at subtidal levels along the Maine coast. This project will supplement complementary experiments by the marine fisheries extension arm of the State of Maine as well as other developments being conducted by industry. Ultimately the use of this resource will depend on market development now underway.

Ocean quahogs (Fig. 7) are now being considered by industry as a possible replacement species for declining stocks of surf clams. The variations in yield, color, and other characteristics are being examined objectively through he development program. Ocean quahogs are also being considered as replacement for certain processed clam

products, particularly chowders and blended products.

ADDITIONAL TECHNOLOGICAL SUPPORT

Further modification in the objectives of the New England Fisheries Development Program activities took place during 1976. Through Congressional action, supplementary funds were made available for accelerated "technology transfer" in southern New England fisheries. These funds are being used to demonstrate harvesting and processing techniques established and proven in other parts of the world and considered as practical for application in the fisheries of the northeastern United States. Examples of work undertaken include the introduction of bottom pair trawling, trawl research, feasibility demonstration of Danish seining, and marketing and processing projects. Other activities include support of research on stabilization of minced fish and related research, use of clam processing wastes, and increased efficiency in crustacean harvest techniques.

Figure 6.—An insulated container is lowered into a herring carrier vessel. The use of chilled seawater (CSW) has extended the period that herring can be held from less than 12 hours to over 36 hours. This has opened the potential for harvesting herring stocks from a wider geographic range than before.

FUTURE FISHERIES DEVELOPMENT ACTIVITIES

With the advent of extended jurisdiction, we are anticipating a broader role for fisheries development throughout the northeast region. A new look at the resource base that will be available to domestic fishermen is called for. Close coordination between industry, the New England and Middle Atlantic Fishery Councils, resource experts, and industry is called for. There are many unanswered questions, perhaps the most significant of which will relate to the interplay between available resource base, allotments to foreign fishermen, interest by U.S. producers and processors, and ability to enter international markets. In the long run, domestic market opportunities will also

Figure 7.—Ocean quahogs, an abundant resource of only marginal interest, now have the opportunity to form the basis of a rapidly expanded fishing effort. This species is a prime candidate to supply large market voids created by lessened availability of the surf clam. It is probable that the ocean quahog may be considered as a basic component of chowders and other blended clam products.

be important considerations as the flow of fisheries products adjusts to the available resources.

To meet these challenges, planning is proceeding to accommodate fisheries development activities throughout the northeast area. Most probable target areas will include an expansion of activities already started under the New England Fisheries Development Program, particularly on the squids, herring and mackerels, silver and red hakes, and ocean quahogs. Some attention will also be directed to better use of surplus freshwater fisheries resources. More involvement is expected in marketing and financial assistance (fleet improvement) to help the domestic industry accommodate the changing demands for products.

SELECTED REFERENCES

General

Alverson, D. L. 1975. Opportunities to increase food production from the world's ocean. Mar. Technol. Soc. J. 9(5):33-40.

Holmsen, A. A. 1973. Potential utilization of underexploited species in southern New England. Univ. Rhode Island, Mar. Memo. Ser. 32, 8 p.

Rathjen, W. F. 1974. New England fisheries development program. Mar. Fish. Rev. 36(11):23-30.

__________. 1975. Unconventional sea harvest. Oceanus, Winter 1975, p. 36-37.

Taber, R. E. 1977. Some recent examples of fishing gear technology development or transfer in New England. Mar. Fish. Rev. 39(2):24-25.

Offshore Crabs

Holmsen, A. A., and H. C. McAllister. 1974. Technological and economic aspects of red crab harvesting and processing. Univ. Rhode Island, Mar. Tech. Rep. 28, 35 p.

Learson, R. J. 1974. New methods of shellfish processing in the U.S. *In* R. Kreuzer (editor), Fishery products, p. 160-167. Fishing News (Books), Ltd., West Byfleet, Engl.

Marchant, A., and A. Holmsen. 1975. Harvesting rock and Jonah crabs in Rhode Island. Some technical and economic aspects. Univ. Rhode Island, Mar. Memo. Ser. 35, 14 p.

Wigley, R. L., R. B. Theroux, and H. E. Murray. 1975. The deep-sea red crab, *Geryon quinquedens*, survey off northeastern United States. Mar. Fish. Rev. 37(8):1-21.

Squid

Ampola, V. G. 1974. Squid—Its potential and status as a U.S. food resource. Mar. Fish. Rev. 36(12):28-32.

FAO (Food Agric. Organ U.N.) 1975. Expert consultation on fishing for squid and other cephalopods. Fish. Rep. 170, Tokyo and Hakodate, p. 1-10 and Suppl. 1 (1976), p. 1-150.

Lux, F. E., W. D. Handwork, and W. F. Rathjen. 1974. The potential for an offshore squid fishery in New England. Mar. Fish. Rev. 36(12):24-27.

Noetzel, B. G. 1974. Economic feasibility of a squid fishery in New England. Economic Research Division, Natl. Mar. Fish. Serv., Wash., D.C., p. 41.

Rathjen, W. R. 1973. Northwest Atlantic squids. Mar. Fish. Rev. 35(12):20-26.

Serchuk, F. M., and W. F. Rathjen. 1974. Aspects of the distribution and abundance of the long-finned squid, *Loligo pealei*, between Cape Hatteras and Georges Bank. Mar. Fish. Rev. 36(1):10-17.

Voss, G. L. 1973. Cephalopod Resources of the World. FAO (Food Agric. Organ. U.N.) Fish. Circ. 149.

Mixed Species

Baker, D. W., and S. E. Hulme. In press. Mixed species utilization. Mar. Fish. Rev.

Earl, P. M. 1975. Hard-fished herring may be underutilized. Natl. Fisherman 56(7):10-11.

Hulme, S. E., and D. W. Baker. In press. Chilled seawater system for bulkholding sea herring. Mar. Fish. Rev.

King, F. J., and J. H. Carver. 1970. How to use nearly all the ocean's food. Commer. Fish. Rev. 32(12):12-21.

McAvoy, H. R., and P. M. Earl. 1977. Export opportunities for New England fishery products. Mar. Fish. Rev. 39(2):26-29.

Martin, R. E. (editor). 1976. Second technical seminar on mechanical recovery and utilization of fish flesh - Boston, Mass. 1974. Proc. Natl. Fish. Inst., Wash., D.C., p. 1-318.

Mendelsohn, J. M. 1974a. Rapid techniques for salt-curing fish: A review. J. Food Sci. 39:125-127.

__________. 1974b. Minced fish in a new form. Mar. Fish. Rev. 36(8):34-36.

Mendelsohn, J. M., T. J. Connors, and J. G. Callan. 1977. A machine for heading and eviscerating small fish. Mar. Fish. Rev. 39(2):11-18.

Ocean Quahogs and Mussels

Anonymous. 1971. Ocean quahog becomes more important as surf and bay clams dwindle. Commer. Fish. Rev. 33(4):17-19.

Hurlburt, C. G., and S. W. Hurlburt. 1975. Blue gold: Mariculture of the edible blue mussel (*Mytilus edulis*). Mar. Fish. Rev. 37(10):10-18.

MFR Paper 1231. From Marine Fisheries Review, *Vol. 39, No. 2, February 1977. Copies of this paper in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

MFR PAPER 1232

Technology in Fisheries Development

LOUIS J. RONSIVALLI

TECHNOLOGY IN THE NATIONAL MARINE FISHERIES SERVICE

Technology may be defined as the application of science and engineering principles and innovations to the solution of practical problems, usually in industrial applications and usually with highly rewarding results (Jones, 1976). The National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, operates three technological facilities that service the country's needs related to the utilization of fish and shellfish, mainly for human food.

For the purpose of this discussion, the application of technology related to the utilization of fish and shellfish may be conveniently divided into two categories, even though they are both concerned with the welfare of the U.S. consumer. The first and most important of these is the role that recognizes the need for an assured supply of fish and shellfish to the U.S. public (Ronsivalli, 1976). The second category of technology activities is in support of fisheries development and it is this category of activities that is the object of this discussion.

FISHERY DEVELOPMENT

The incentive to develop new fisheries is generated by a variety of factors. Many of the conventional species are being overfished. The catch per unit of effort is steadily decreasing and the proportion of unusable species brought aboard the vessel is increasing. Species like the red crab and the Jonah crab, readily available to fishermen, have gone virtually untouched while the pressure on lobster stocks has created a reduction in the catch per unit of effort in the latter species. The potential for creating an acceptance for little used species in the United States has excellent precedence. Some of the species which are now highly valued (e.g., haddock and halibut) were once considered to be trash fish by American fishermen. Now they are in such high demand that their stocks are badly depleted. Thus, the development of new fisheries is both practical and feasible and serves two purposes. It results in an overall increased domestic catch and it helps to relieve the fishing pressure on conventional species by redistributing some of it among underutilized species.

Increasing the Domestic Catch

The successful development of a fishery translates into increased domestic landings. This is especially desirable in order to try to reverse a trend of increasing imports which now reportedly accounts for about two-thirds of the U.S. consumption. While a heavy reliance on imports may be tolerable for the present, it must remain a cause for considerable concern because of the growing probability of food supply crises in the normal international food trade.

Redistribution of Fishing Pressure

Figure 1 attempts to illustrate how fish and shellfish play an important part in contributing to the total U.S. food needs. It also attempts to show the source of this class of foods and some of the factors that affect their availability. The list is by no means complete. For this purpose, the diagram, originally designed to form the basis for a proposed computer program for a national seafood policy, omits all elements except those that affect commercial fishing, and even this list is not complete. However, there is enough information supplied to illustrate a point.

Factor number seven indicates that the domestic supply derived from commercial fishing is affected by the need to know that stocks are in sufficient supply. This information, for any given species, represents a complicated problem which NMFS biologists attempt to solve by stock assessment, environmental studies, etc., and it represents a management control problem. When a species is in danger of being overfished, it is at that point that the development of an alternate fishery becomes an expedient endeavor which takes the fishing pressure off the conventional species while at the same time maintains the fishing effort and the productivity. Thus, we can see that the establishment of a new fishery has the potential for resolving several crises simultaneously: 1) those concerned with relieving the fishing pressure on species that are in danger of depletion welcome any activity that

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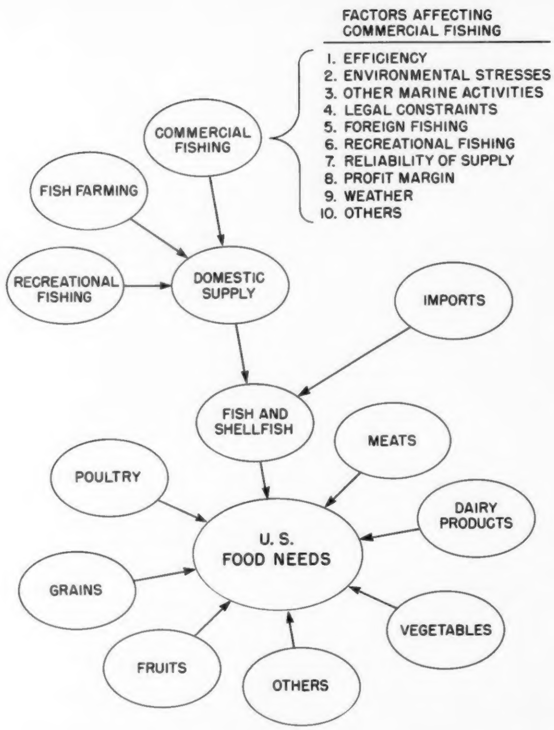

Figure 1.—Some factors that affect U.S. food needs.

provides a reduction in the harvest effort; 2) fishermen engaged in fishing for species that are in danger of becoming depleted, who are being restricted by regulations, welcome the opportunity to stay in business by fishing for a more plentiful species; 3) fishermen presently wasting significant amounts of effort to harvest proportionally large amounts of unusable fish and to cull them out and to dispose of them at sea would welcome the opportunity to be able to sell all of their catch, regardless of the species; and 4) the consumer who must settle for fewer of the conventional species and at higher prices welcomes the opportunity to purchase alternative food species at relatively moderate prices.

TECHNOLOGY IN FISHERY DEVELOPMENT

The role of technology in fishery development covers a broad area that starts with the harvesting of the fish, continues throughout the processing, handling, and distribution of the product, and ends at the point where it is consumed as food. The extent of the technological input may vary from fishery to fishery depending on the needs.

The development of a new fishery may require the modification of presently available harvesting gear or it may require the development of new gear. The criteria for suitable gear such as ease of handling, effect on quality of catch, size of openings, and the nature of the material of which it is made apply to all species, and the available gear has to be evaluated and sometimes tested to determine its suitability for a new fishery. The bulk of the activities in gear research is in engineering.

Once the fish die or are killed, the technologist handles them as food, and here he employs all of the skills of the food technologist, which include microbiology, toxicology, chemistry, physics, nutrition, mathematics, engineering, and others. He studies the effects of processing on the organoleptic quality of the product and he monitors microbiological changes. He studies problems in off-flavor development like rancidity and discoloration such as the Maillard reaction. He investigates texture changes such as those resulting in toughening from the denaturation of protein and those resulting in softening such as from autolysis. He explores the environmental and processing effects on the product for possible toxicity when either the environment or the process has the potential for either adulterating the product or introducing reactants for the formation of toxic substances.

The technologist is, futhermore, constantly challenged by processing or handling techniques that tend to deteriorate the quality of the product and he is concerned with the design of packaging since the proper package can prevent quality deterioration through oxidative reactions and dehydration and, in some cases, light catalyzed reactions. The technologist is concerned with formulating standards of quality and devising physical and chemical tests for determining the various grades of quality. The technologist is also concerned with problems of human handling such as sanitation, inefficiency, variable yields, poor economics, and he is concerned with problems of mechanical processing such as adulteration from lubricants and metal chips. He is concerned about the need and use of additives and about the nutritive composition of seafoods. He studies the parameters of freezing, dehydration, canning, and other processes for their effects on quality, yields, and economics, and he assists the industry in the technological activities that it cannot do for itself. This area of assistance may involve the technologist deeply when unexpected variables in the parameters of a new process produce undesirable results. Thus, the role of the technologist to help solve the chemical, microbiological, and engineering problems of a new process may be crucial to its successful industrial implementation.

The successful conduct of technological research in fishery development depends on many things, but paramount among these is the need to keep the commitment to constituents. For example, the obligation to assure a continuing seafood supply to the general public must be met. In addition,

there are obligations in communicating and working with industry, upon whose performance and welfare the effectiveness of our conduct on the public's behalf depends. This is an important duty that the technologist cannot afford to ignore. To quote a British article from the Fisheries Research and Development Board (Anonymous, 1975) "Fishermen regard the work of scientists as something abstract which has no real meaning for them" and "The basic problem is that as far as gear research and development is concerned, the industry does not know what is going on (they mean in research) and the laboratories do not know what the industry needs." In the United States this problem is recognized, and the New England Fishery Development Program (a government-industry collaborative effort) represents one attempt to resolve it.

When a conventional species such as the surf clam is in danger of becoming depleted, it would be desirable if conservationists would merely give a signal that would divert fishing pressure to a relatively underutilized species like ocean quahogs. It is then essential that processors would buy the quahogs from the fishermen and process them into various products for consumers. However, the conversion is not simple to implement. The meats of the ocean quahog are darker than those of the surf clams and they are stronger tasting (sometimes objectionably). Ocean quahogs are generally shucked by hand, making the meats more costly to produce than surf clam meats which are removed from their shells mechanically. Even if we do not consider the economics, it should be obvious that to introduce the quahog to markets accustomed to the surf clam requires that it either be made into an acceptable substitute by minimizing or eliminating the differences between the two or that it be used to make new products with an acceptance of their own. In either case there are problems requiring technological input. (While marketing and economics are necessary and related activities, these will be considered later.) Physical, chemical, and engineering principles can be applied to reduce the strong taste of the quahog meats and to automate the removal of meats from the shells and lighten their color. Some of the problems associated with ocean quahogs have been solved by NMFS technologists (Mendelsohn[1], pers. commun.).

A consideration of the federal expenditure to support this work is in order. It would have been better if taxpayers' money had not been used to do this work and if fish processors did their own technological research. After all, they are the ones that stand to realize a profit from the research. This line of thought can be carried even further. It might also be argued that fishermen should do their own stock assessment and stock management. In this way they could determine for themselves why they cannot harvest as many surf clams per unit effort as they did in the past and which species could be considered as substitutes for the surf clams and whether the stock of substitute species is of sufficient size. After all, the fishermen are the ones who benefit from this activity. Part of the answer is that neither the fishermen nor the processors have the economic capability to afford the research to determine the need for a new fishery and then to develop it. Even if a member of either group could afford any of the required research, this approach would imply a great duplication of effort, the costs of which would have to be borne by the consumer. The other part of the answer is that the fishermen and processors are only intermediate beneficiaries of the federally funded effort and that the ultimate and long-term beneficiaries are the American taxpayers, because these activities assure them of the availability of seafood protein of the widest variety and of the highest quality. In a way, government and the industry become partners in providing an assured supply of an important food commodity to the American consumer. It is not simply a case of federal support to industry.

One may or may not agree with the above observations, and one may choose to even ignore the situation, but the facts are not altered by opinion or by lack of attention. For example, industry will not on its own initiative develop a new fishery. While most of us believe that it cannot (has neither the capability nor the desire), there are those who believe that it can do it but chooses not to. Regardless of which explanation is correct, obviously there will be no pattern of fishery development if we expect industry to do it. Even if we do all of the necessary biological investigation and provide all of the required technology, the record shows that industry will not carry the ball simply because we think they should. When an action is necessary in the interest of the public, then its undertaking cannot be left to chance. It is, therefore, the role of government to take the necessary steps to maintain for the U.S. taxpayer the opportunity to have for the present, and for the future, a viable resource of fish and shellfish, primarily for food, but also for recreational or sport fishing and to employ any suitable strategy to effect its conservation policy without sacrificing jobs and without reducing the domestic production of seafoods.

National Marine Fisheries Service technologists have had a reasonable record of accomplishments when their efforts were integrated with machine manufacturers in a collaborative effort or when the proper set of coincidences set the stage for success. To illustrate, the following examples are given.

Success by Collaborative Effort

When NMFS technologists collaborated with equipment manufacturers, they successfully promoted the use of microwave ovens for thawing and tempering operations. (Several millions of dollars worth of these ovens have been put into operation, with distinct advantages to processors, as a result of that effort.) The technologists were able to demonstrate the many advantages of microwave thawing and these included comparisons of processing rates, sanitation, yields, organoleptic quality, and shelf life of the product, space requirements, etc. between conventionally thawed products and microwave-thawed products. The same kind of collaboration led to other successes which include the introduction of special centrifuges for separating

[1]Mendelsohn, J. M. 1976. Personal communication. Research Food Technologist at the Northeast Utilization Research Center, National Marine Fisheries Service, Emerson Avenue, Gloucester, MA 01930.

shell from meats of crabs and of deboning machinery for finfish. In all of these cases, certain essential elements were present. First there was a clear definition of the problem by the fish processors. Then there was the collaboration between machine producers who provided the marketing and economics capability and NMFS technologists who tested the processing effectiveness of the machines and who assisted processors in setting up and operating the processing lines. Experience shows that the processors would not have bought the machines if they had any doubt regarding the economics or the effectiveness of using them.

Success by Coincidence

When the availability of a popular commercial species declines significantly, fishermen who normally harvest it begin to feel the adverse economics of the reduced catch per unit effort and the pressure from the market demand. Such a situation exists in the lobster and crab fisheries. The red crab, *Geryon quinquedens*, was not fished commercially as recently as 3 years ago even though NMFS technologists had ascertained the feasibility of establishing the red crab fishery, albeit a small one according to fishery biologists. However, a combination of partly idle boats, a strong market demand, similarity between the edible characteristics of the product and those of lobsters and other crabs, and apparently reasonable economics stimulated industry to the point that the commercial landings of this species is currently about 2 million pounds per year. In another instance a visit to Europe by an eastern U.S. processor educated him to a guaranteed market for dogfish, the proper skinning procedure (important in processing dogfish), and a favorable economic analysis. As a consequence, he expects to begin processing dogfish soon.

The situations described above led to successful innovations by circumstances partly or completely beyond the control of NMFS. It is as though there exists a formula that leads to successful implementation but is, as yet, not defined. It appears that too often the formula we use excludes vital terms that make it incomplete. For example, too often we have expected technological research by itself to accomplish a mission such as the development of a fishery. Other times, we employed a high-powered marketing thrust to virtually develop a fishery, but the accomplishments have been shallow. The establishment of the New England Fishery Development Program added two vital terms to the formula. It added industry's input and it integrated biology and technology. Industry assisted in defining the problems, in setting priorities, in evaluating the approaches to the problem, and in monitoring the research progress. But it seems that the formula is still incomplete.

The attempt at industrial implementation of NMFS technology research and development has often been frustrated. In recent years especially, numerous potentially economically important fishery products developed at NMFS utilization laboratories have yet to be assimilated in commerce. The technologists believe that the reason for this undesirable situation is due to a lack of marketing effort. However, marketing personnel attribute the impasse to the resistance of potential buyers who will not buy unless they can be assured of two bits of information: 1) cost of product and 2) an identified source of supply. When they approach a potential processor he resists because he too needs two bits of information: 1) production cost and 2) market potential. Thus, we cannot generate a market because there is no processor for the product, and we cannot get a processor interested in producing the product because there is no market for it. The foregoing represents a circle without a point of entry and the situation is analagous to trying to establish as to whether the first egg came before the first chicken or vice versa. It seems that the only way to break into the circle is to do it via an integrated approach which includes inputs by fishery biologists, fishermen, processors, technologists, marketing specialists, and economists. It appears that all of these elements are vital and that there should be complete collaboration from beginning to end—from definition of the problems, assignment of priorities, evaluation of research proposals, and monitoring of research progress to the final step where the results of the research efforts are finally put into commercial practice. Input by fishery biologists is vital because we have to have an estimate of the size of the resources, the sustainable annual yield, etc. Input by fishermen and processors is essential because we need their help to keep the progress relevant and we need to be assured of their interest and commitment in the project. We need the technological input to solve problems in harvesting, handling, processing, quality control, etc., and we need help from marketing experts to maintain an assurance of the market potential. Finally, and perhaps most important, there needs to be a constant testing of economic feasibility because the economics of the proposed innovation is the critical consideration that determines whether a project should be permitted to proceed or to be terminated.

In summary then, the role of technology in fishery development is changing from one based on the assumption that:

$$\text{Technology} = \text{Fishery Development} \tag{1}$$

(a formula that too often has resulted in frustration) to one that is based on the idea that:

$$\text{Technology} + \text{Biology} + \text{Industry Input} = \text{Fishery Development}. \tag{2}$$

Equation (2) has demonstrated a greater potential for success than Equation (1). However, it appears that a more promising equation is:

$$\text{Technology} + \text{Biology} + \text{Industry Input} + \text{Marketing} + \text{Economics} = \text{Fishery Development}.$$

LITERATURE CITED

Anonymous. 1975. Second report for period 1974-1975. Fish. Res. Dev. Board. HMSO, Lond., 85 p.

Jones, R. A. 1976. Editorial. Ind. Res. (18):7.

Ronsivalli, L. J. 1976. The role of fish in meeting the world's food needs. Mar. Fish. Rev. 38(6):1-3.

MFR Paper 1233. From Marine Fisheries Review, *Vol. 39, No. 2, February 1977. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

MFR PAPER 1233

A Machine for Heading and Eviscerating Small Fish

J. M. MENDELSOHN, T. J. CONNORS, and J. G. CALLAN

ABSTRACT—A commercial fish eviscerating machine has been modified to automatically head, eviscerate, and thoroughly clean whiting, Merluccius bilinearis, *and similarly shaped species of fish. The unit will process about 60 fish per minute, each weighing between 1/4 and 1-1/2 pounds. The cleaned fish, (butterflied, but with the backbone remaining) can be battered and breaded and deep-fat fried or can be directly processed into minced fish with the use of a meat/bone separator.*

INTRODUCTION

Today when there is a constant demand for nutritious foods that are high in protein, more thought is being given to our natural marine resources. However, with the decrease in landings of the traditional fish species and the increased demand for fishery products, the full use of the underutilized species is essential. The use of the entire fish stock is desirable, both from a conservation view (provided resource management is maintained) and from an economic aspect to expand the fishing season for more productive use of the fisherman's time.

The ever increasing demand for processed fishery products has prompted the fish processing industry to use meat/bone separators and other automatic equipment to increase the edible yield of fish (Miyauchi and Steinberg, 1970). This is especially true with very bony or small fish where it is not economically feasible to remove the bones by hand. This flesh, recovered in minced form, can be frozen into blocks for future use in sticks and portions or it can be made into a variety of products such as fish cakes and salt-cured fish (Mendelsohn, 1974), chowders, heat-processed products, etc. (Anderson and Mendelsohn, 1971), and as an extender in meat dishes (King, 1973). Thus, meat/bone separators, first popular in Japan, are now being installed in the United States and in foreign countries.

The traditional method of preparing fish for processing by a meat/bone separator is to first remove the head with a circular blade positioned on a conveyer line. After the head is cut off, the fish is conveyed to a scaling machine (Fig. 1). Here the fish are tumbled within a metal screen in a heavy spray of water to remove the scales. In the conventional commercial scaling operation, some of the viscera in the belly cavity are also removed. In some processing plants, the loose viscera which remains after the scaling operation are superficially removed by hand. However, the blood along the backbone and the kidney, swimbladder, and other attached small pieces of viscera are not removed.

However, in order to produce high quality products prepared from minced fish flesh collected from a meat/bone separator, the fish must be properly headed, scaled, cleaned, and washed thoroughly. The quality of the minced flesh is judged by the absence of viscera, blood, bone, skin, scales, sound (swim) bladder, and in species such as whiting, *Merluccius bilinearis*, the belly lining (a black membrane lining the visceral cavity).

SURVEY OF CLEANING MACHINES

A survey of gutting and cleaning machines for preparing fish for meat/bone separators was conducted. At the start of this project no commercial machine was available to automatically head and thoroughly clean whiting and similar species. Several machines appeared suitable to meet the gutting and cleaning requirements, but most were very costly and not adaptable to handling mixed species. Not only were different species a problem but also size and range and black belly lining removal. One machine[1] appeared to satisfy most of the requirements. At a preliminary trial it cleaned small freshwater smelt successfully and with modifications appeared suitable for

[1]Model 22, manufactured by LaPine Bros., Inc., Gladstone, Mich. Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

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cleaning larger fish. Therefore, this machine was purchased. However, since the start of this project, several new machines have been introduced that may meet the original requirements. We have not checked the efficiencies of these machines for whiting; therefore, no comparisons can be made.

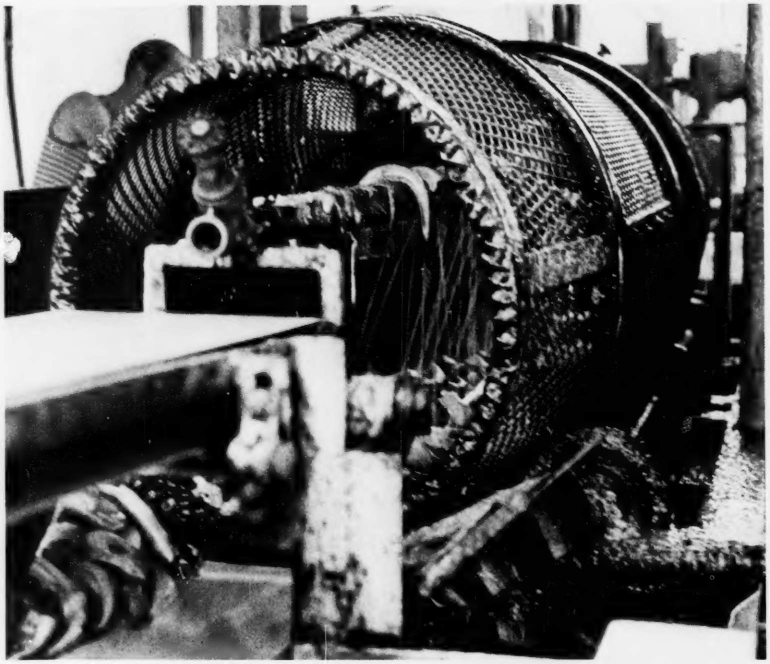


Figure 1.—A conventional rotating scaling machine now in use in the fishing industry.

ORIGINAL LAPINE GUTTING MACHINE

As purchased, the LaPine machine was equipped with a V-shaped feeding trough, two spring-loaded rubber belts to hold the fish, a cutting wheel (rotating blade), and two aluminum cleaning wheels (drilled blind holes around periphery and on flat sides (Fig. 2)). The fish were introduced to the gutting machine through the adjustable V-shaped trough up to the point where the belts grabbed the fish to be cleaned. At each station, water could be introduced to clean the blade, wheels, and wash out the visceral cavity.

In using this original machine, commercially headed and scaled whiting were fed to it belly down, and the fish were carried forward between the two spring-loaded rubber belts. The belt speed was set at 43 feet/minute, but with minor gear changes, it could be adjusted upward. While the unit was effective for small whiting, the black belly lining and the kidney in larger whiting were not completely removed. On further processing of the minced flesh into blocks, and other products, this belly lining appeared as black spots, and the pieces of kidney and viscera appeared as colored spots in the frozen product.

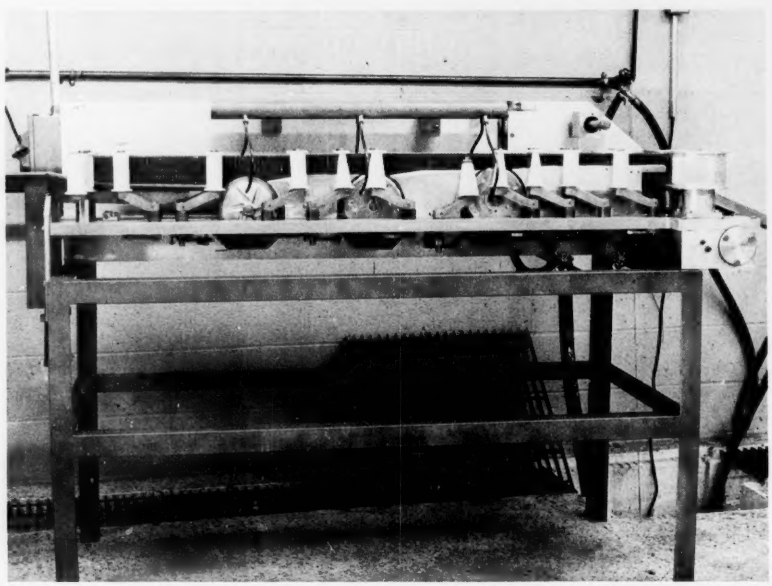


Figure 2.—The original LaPine fish cleaning machine as purchased from the manufacturer.

MODIFICATIONS MADE TO LAPINE GUTTING MACHINE

To make the original LaPine machine satisfactory for preparing whiting for processing in a meat/bone separator, many modifications were made. Since the machine could only eviscerate fish, an automatic heading unit was designed and installed just prior to the cleaning machine. The heading unit consists of a conveyor with tapered hardwood cleats spaced 3 inches apart (Fig. 3). The distance between cleats is 1 inch at the base and 2½ inches at the top. This conveyor leads to a 12-inch diameter rotating stainless steel adjustable blade (Fig. 4) which cuts off the head just behind the gills. Each of the cleats has a section removed so that there is formed a groove along the entire track to allow a spring-loaded plastic tongue to ride along the groove. The plastic tongue acts as a spring to hold down the body of the fish to prevent it from

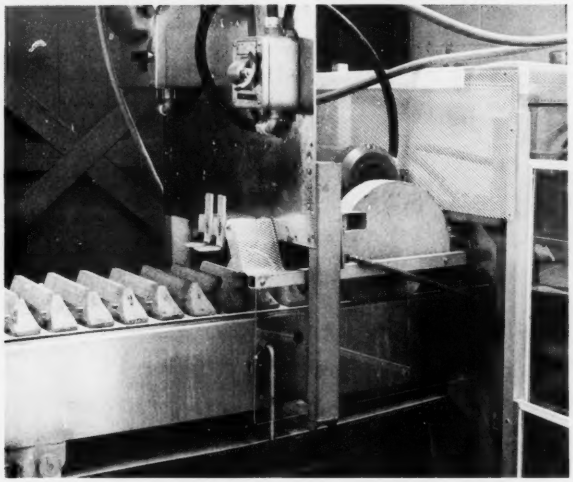


Figure 3.—The cleated conveyor used to bring the fish by the rotating blade to be headed.

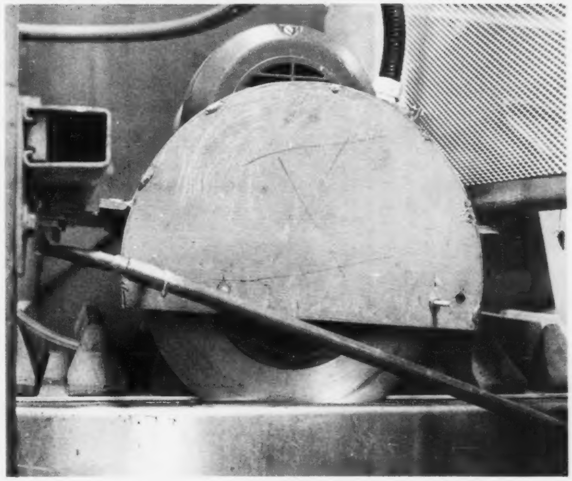


Figure 4.—The rotating blade for heading the fish.

rolling as it is being headed. Keeping the fish upright until it is gripped by the carrier belts of the gutting and cleaning machine is essential for successful evisceration.

After the fish are headed, the cleated conveyor carries them to the entrance of the gutting and cleaning machine. At this point, a transfer device pulls them out of the conveyor and deposits them between the belts of the gutting machine. The transfer device consists of two sprockets and a chain on which is mounted a pair of spring-loaded striker arms, each equipped with a pair of sharp spikes (Fig. 5). A striker arm stops directly above the conveyor and as a fish passes under, the striker is released and drives the spikes into the back of the fish. The spikes on the chain conveyor drag the fish out of the cleat conveyor and into the entrance of the spring-loaded carrier belts of the gutting machine. This chain conveyor is equipped with a variable speed drive which allows it to be run at the highest speed at which operators can load the cleated conveyor.

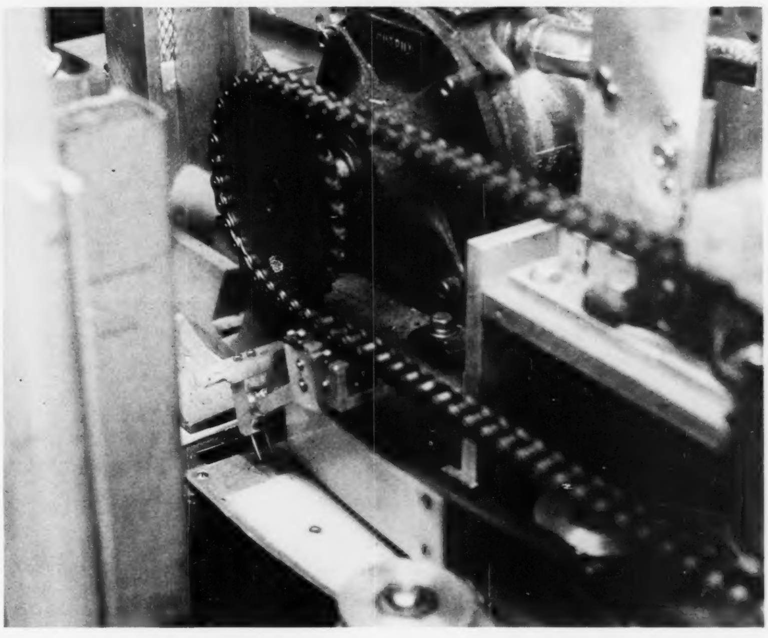


Figure 5.—The device for transferring the fish from the header to the cleaning machine.

Between the heading machine and cleaning machine there is an adjustable trough or slide which controls the depth of cut made by the slitting knife. This is positioned by an air-operated cylinder and can be manually adjusted, depending on the size of the fish to be cleaned. The machine will clean whiting varying in size from about 8 to 14 inches with no adjustment; however, if all the fish in a given lot are small (about 8 inches), the inlet trough can be adjusted upward specifically for these fish and adjusted down for larger fish. This adjustment makes it possible to obtain maximum yield.

The carrier belts hold the fish in line as they travel over the rotary slitting knife (Fig. 6). This 6-inch diameter stainless steel knife cuts deep into the belly of the fish up to the backbone. As with the heading wheel, this wheel has a stream of water to wash it and keep it clean. Above this blade there is a plastic hold-down arm to keep the fish from riding up while being slit. The fish

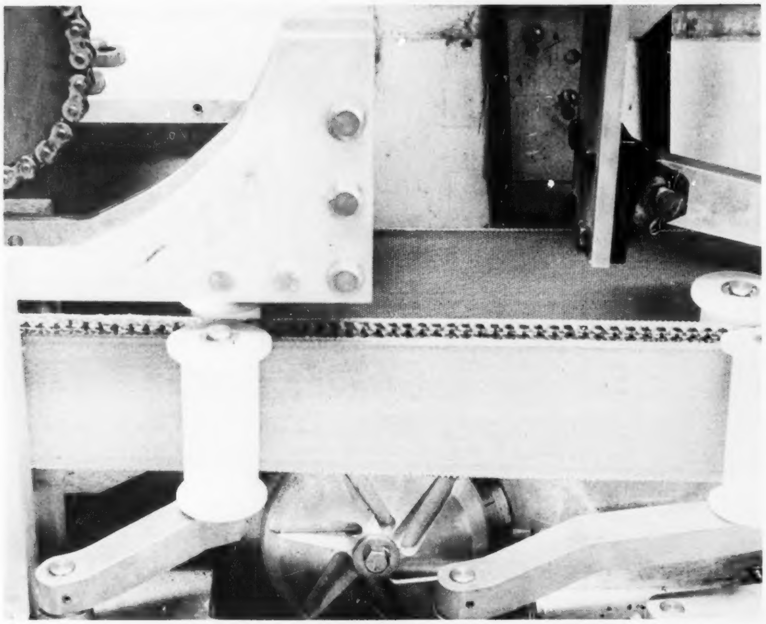


Figure 6.—The belly slitting blade to open the fish for cleaning.

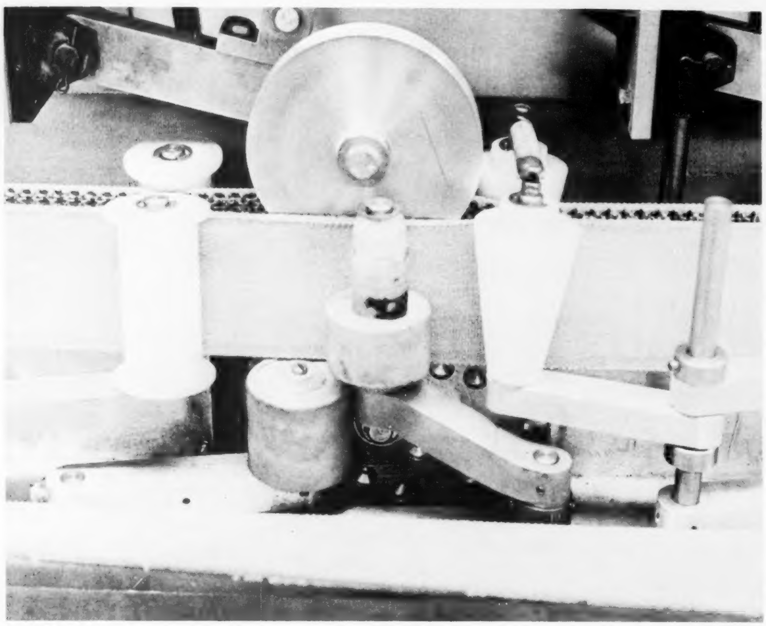


Figure 7.—The section of the modified machine showing the aluminum cleaning wheel with the fish hold-down roller and soft rubber wheels to press the inside of the fish against the cleaning wheel.

now pass over a smooth aluminum bar, used as a guide between the rubber belts, to the first cleaning station. At this point, the fish pass over a 6-inch diameter aluminum cleaning wheel or disc with a rounded periphery that has blind drilled holes along the outside edge and along the flat sides (Fig. 7). These cleaning wheels were part of the original gutting machine. The pattern of holes is arranged to overlap each other for complete cleaning of the inside of the fish. Running water is used to keep this wheel clean.

In the original machine, the 3-inch rubber belts were only wide enough to hold the outsides of the small fish against the cleaning wheel. With the larger whiting, the longer belly flaps hung below the 3-inch belts and the lower portion of the belly flaps were not adequately cleaned. Therefore, two air pressure controlled soft rubber wheels were installed just below the rubber belt (Fig. 7). One was placed on each side of the machine to hold the tips of the long belly flaps of the larger fish against the cleaning wheel. With these secondary holding wheels the insides of both small and large fish can now be effectively cleaned.

Another smooth aluminum bar, between the rubber belts, guides the fish to the second cleaning wheel. In the original machine, this 6-inch aluminum cleaning wheel was similar to the first cleaning wheel. However, in the modified unit, a cleaning wheel designed especially for herring, which is tapered at the top to fit more closely into the belly cavity of the fish, was installed. This modified wheel also has blind holes drilled around the periphery, drilled slots on the outer tapered edge, and sharp blind holes along the flat sides. It is also washed with water. As with the first cleaning wheel, the 3-inch belt would not hold the entire body of the larger fish against the wheel. Therefore, another set of air pressure controlled soft rubber wheels were installed just below the rubber belts to hold the long belly flaps in the larger fish against the cleaning wheels.

In the original machine, as the larger fish passed over the cleaning wheels, they were forced above the rubber holding belts and were not cleaned properly. To keep the fish in position on the cleaning wheels, two pressure-controlled, free-rolling, hold-down wheels were installed above the cleaning discs. These grooved wheels hold the fish against the disc for complete cleaning (Fig. 7).

From the second cleaning wheel the fish pass over another aluminum bar and onto the final washing and cleanup

conveyor. The fish ride on one belt and are held down from above by two belts (Fig. 8). The fish are held by the V-belts to a point on the machine where the belly flaps are spread out almost horizontally (Fig. 9). A stream of water is spashed on the surface of the spreader as a lubricant to keep the belly flaps from dragging. With the belly flaps spread wide open, they now pass over a spirally grooved, tapered, rotating aluminum wheel. The fish are held down on this rotating wheel by a spring-loaded wheel on top (Fig. 9). This cleaning wheel removes the last traces of black belly lining and any viscera that were not removed by the two previous cleaning wheels. The cleaned fish are now conveyed to the meat/bone separator for further processing.

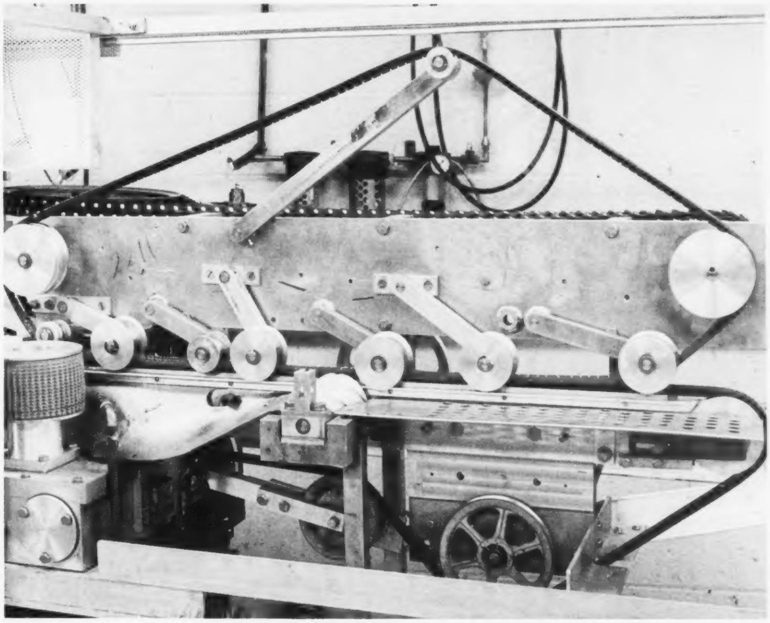


Figure 8.—The conveyor which brings the fish to their final washing and cleaning.

COLLECTION OF MINCED FISH FLESH

As the fish leave the cleaning machine (belly down), they are made to flip over on their backs (belly up and fully exposed) onto a conveyor (Fig. 10) leading to the meat/bone separator. This offers an inspection point to assess the cleaning effectiveness of the eviscerator. An inspection of the fish is made, and any uncleaned fish are removed from the line. The completely cleaned fish are then conveyed directly into the meat/bone separator[2].

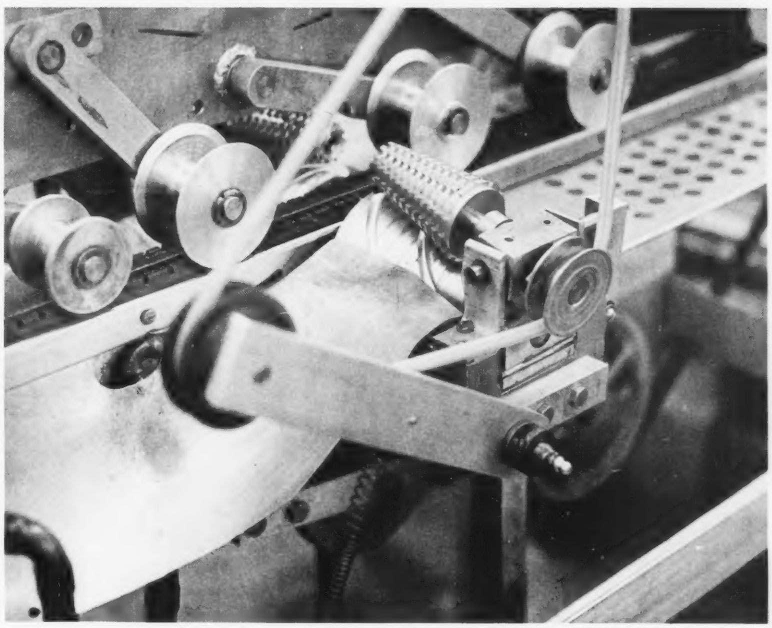


Figure 9.—The device which gives the fish their final washing and cleaning.

RESULTS AND DISCUSSION

An overall view of the automatic fish header and eviscerator is seen in Figure 11. The number of fish that can be headed and cleaned is now around 60 fish per minute but could be increased by adding an orienter to align the fish automatically for heading just behind the gills. The limiting factor at present is the feeding of the fish into the cleat conveyor. It takes two people to properly feed 60 whiting per minute into the machine. Figure 12 shows a comparison between a whiting cleaned by the modified LaPine machine and a whiting headed and dressed in the conventional manner. The fish processed by the LaPine machine (on the right of Fig. 12) is thoroughly cleaned of all the viscera, blood, and black belly lining, while the conventionally processed fish (in the center of Fig. 12) contains blood, kidney, viscera, and black belly lining. The thorough cleaning and washing also reduces the number of bacteria that is normally present in high concentration in the visceral cavity. Products made from the fully cleaned fish retain their quality longer,

[2] Model 15 Bibun meat/bone separator.

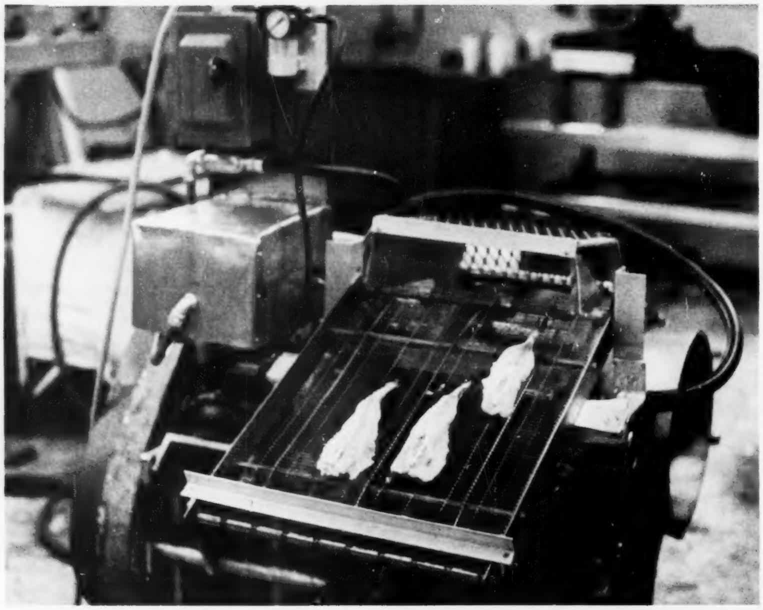


Figure 10.—The cleaned fish as they enter the meat/bone separator.

Table 1.—Cleaning efficiency[1] of the modified LaPine machine.

Whiting length (inches)	Cleaning efficiency[2] (percent)
8-10	94
10-12	100
12-13	97
14-16	90
16	80

[1]Complete removal of head and viscera.
[2]Average results from duplicate experiments.

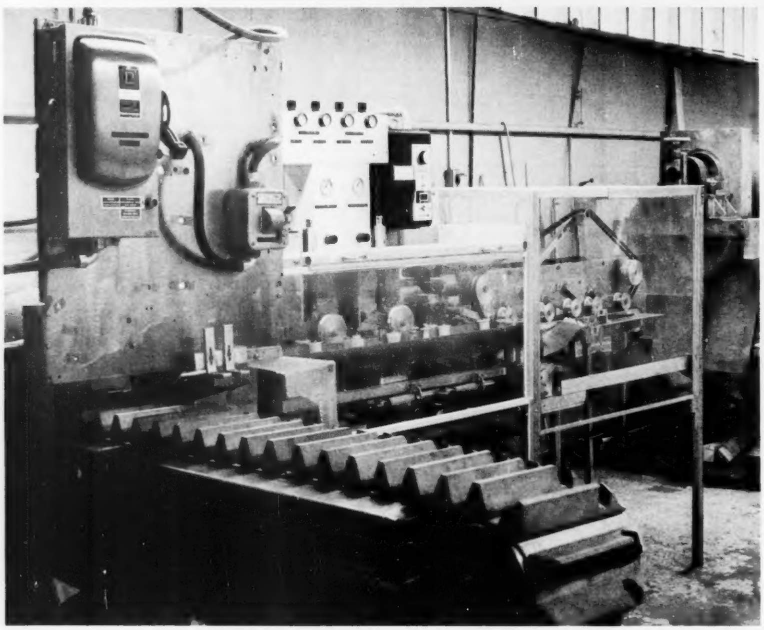


Figure 11.—An overall view of the automatic LaPine heading and cleaning machine.

have a better appearance, and extended storage stability. It is even more important to remove all the viscera, including blood and kidney (where the bacteria reside) for use in minced products. The mincing process increases the surface area of the flesh, making it more susceptible to bacterial spoilage and, in fatty fish, to development of rancidity.

The efficiency of the modified LaPine cleaning machine was determined using whiting of various sizes. The settings on the LaPine machine were held constant during the experiment, except for the inlet feeder. For the lots of whiting containing small fish (between 8 and 10 inches) or large fish (16 inches or longer), the inlet feed was adjusted to compensate for the size. The cleaning efficiency results from two duplicate experiments are shown in Table 1. As can be seen from this table, the cleaning efficiency is highest for whiting between 10 and 14 inches, which is within the range in which most of the whiting fall that are landed in this area. Several attempts were made to clean whiting weighing over 2 pounds that were found in the lot of fish measuring over 16 inches. Although these fish were headed properly, they would not transfer from the heading conveyor to the cleaning machine. The pins in the transfer conveyor would not set deep enough into the back of the very large fish to pull them from the cleat conveyor to the cleaning machine. These fish just passed by the cleaning machine and fell off the heading conveyor. Therefore, with the machine set for cleaning whiting between 10 and 14 inches, the fish going into the machine should be limited in length to about 16 inches and in weight to about 1½ pounds. Modifications to the machine can be made to handle the very large whiting, but this would reduce the efficiency of the machine to clean the smaller fish.

Recovery yields after each phase of the process were also determined. The results from each size lot are shown in Table 2. A composite of the results from the various sizes of fish is given in the last two columns of this table.

As seen in Table 1, all the whiting between 10 and 14 inches were almost fully cleaned and the larger (longer) the fish, the lower the efficiency. This is fortunate, for most of the whiting landed locally measure between 10 and 14 inches, although there may be some smaller and some larger fish in the

catch. Also, in Table 2, the highest yields were obtained from fish weighing between 1/2 and 1 pound. These fish are again within the 10 to 14 inch range, which constitutes the bulk of the whiting landed. To show the relationship between the length and weight of whiting, an average length-to-weight ratio was determined using whiting between 10 and 14 inches. The composite value (35 fish) found is that a whiting 11.6 inches long weighs 0.6 pounds. This ratio is not always constant and depends mainly on whether the fish are feeding.

CONCLUSIONS AND RECOMMENDATIONS

The modified LaPine machine will head and completely clean the bulk of the whiting landed (10-14 inches in length) without changing the operating conditions signficantly. Minor adjustments to the modified LaPine machine controls can be made to handle batches of smaller and larger fish for more efficiency.

The fish that have passed through the modified LaPine machine can be used directly as a frozen, raw, or fried product or put through the meat/bone separator. In either case, the fish are completely cleaned and can be processed directly into high-quality products.

To further automate the heading and cleaning operation, several pieces of auxiliary equipment are needed to complete the processing line. Since the unit works well with whiting up to 16 inches in length, a divergent slot grader could be used to sort the fish into three size categories—smaller than 8 inches, 8 to 16 inches, and larger than 16 inches. The machine works best when the controls are set for the middle range of 10 to 14 inches. For more complete cleaning of the other sizes of fish, the controls can be readjusted for the smaller fish and again for the larger fish. These changes can be engineered to automatically respond to the various sizes of fish.

All the fish that are run through the machine should be scaled to keep the scales from getting into the mince or into the batter and breaded fried products. Therefore, a scaler should be part of the auxiliary equipment.

The speed at which the machine can be run is now limited by the hand loading and positioning of the fish in the slots of the feed conveyor. The fish are positioned to sever the heads just behind the gills. The conveyor speed is approximately 60 fish per minute, set at this rate by the capability of two workers to properly feed the conveyor. By using an automatic orientor to position the fish for heading, the production rate could probably be increased to 75 fish per minute. This would reduce hand labor costs and increase the efficiency of the operation.

An exploratory cost survey of the

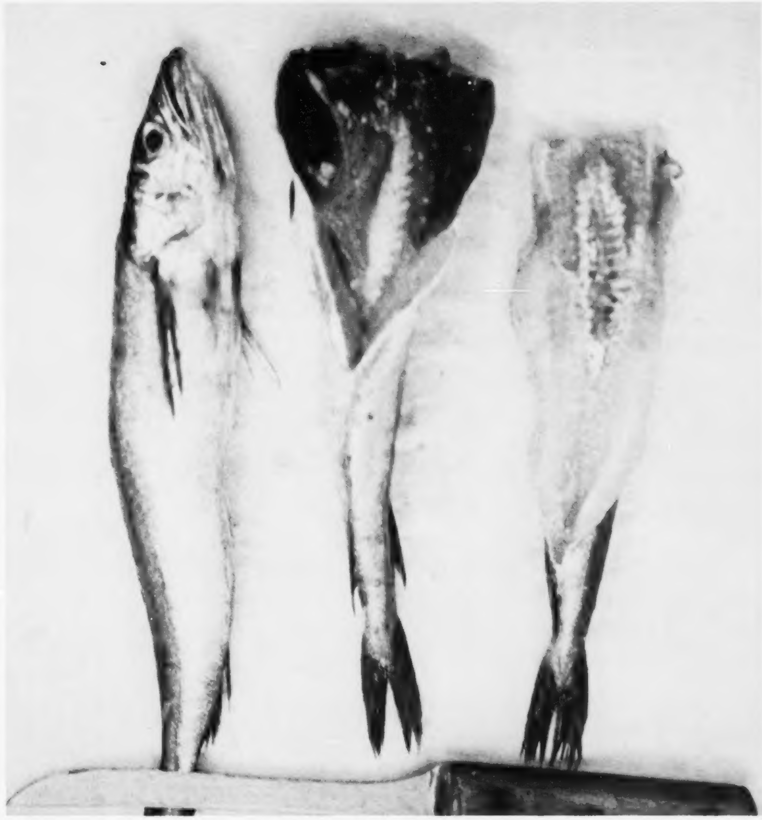


Figure 12.—A comparison of whiting cleaned by the conventional commercial method and by the automatic LaPine machine.

Table 2.—Recoveries[1] from each phase of the process.

	Percent yield by weight of fish				Average recovery (%)	
	Up to ½ lb	½-¾ lb	¾-1 lb	Over 1 lb	Whole fish	Headed fish
Whole whiting	100%	100%	100%	100%	100%	—
Headed fish	70.0	70.5	70.4	68.5	69.9	100%
Cleaned fish (completely eviscerated)	49.8	52.5	53.7	51.1	51.9	74.3
Minced fish (collected from Bibun meat/bone separator)	43.4	47.8	50.3	40.0	45.4	65.0

[1]Average results from duplicate experiments.

commercial heading and cleaning machines now available on the market shows them to be very expensive. Preliminary estimates of the cost for building a modified LaPine machine indicate that its selling price should be less.

Plans are underway to test the modified machine under commercial conditions. The unit will be put into a commercial fish processing plant where its efficiency, throughput, and quality of product will be determined.

LITERATURE CITED

Anderson, M. L., and J. M. Mendelsohn. 1971. A study to develop new products from whiting and other underutilized species. Tech. Assist. Proj. 01-6-09131, U.S. Dep. Commer., Econ. Dev. Admin., Wash., D.C., 67 p.

King, F. J. 1973. Acceptability of main dishes (entrees) based on mixtures of ground beef with ground fish obtained from under-used sources. J. Milk Food Technol. 36:504-508.

Mendelsohn, J. M. 1974. A study: Expanded processing techniques, production costs and market survey of underutilized fish species. Tech. Assist. Proj. 01-6-09131-2. U.S. Dep. Commer., Econ. Dev. Admin., Wash., D.C., 51 p.

Miyauchi, D., and M. Steinberg. 1970. Machine separation of edible flesh from fish. U.S. Fish Wildl. Serv., Fish. Ind. Res. 6:165-171.

MFR Paper 1234. From Marine Fisheries Review, *Vol. 39, No. 2, February 1977. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

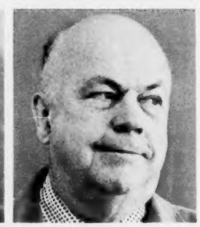
MFR PAPER 1234

Development of a Color Measuring System for Minced Fish Blocks

F. J. KING and J. J. RYAN

ABSTRACT—The present interim grade standard for minced fish blocks has three categories of color styles, but it does not include a method for classifying a given block into one of these categories. This report describes a system for color classification. It is based on a reflectance spectrophotometer and Munsell neutral value standards. A set of color pictures is included to visualize what is measured by these Munsell "shades-of-gray" standards.


King


Ryan

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The proposed Interim Standards for Grades of Frozen Minced Fish Blocks contain three color classifications: "white", "light", and "dark" (National Marine Fisheries Service, 1975). This is the first seafood grading standard which classifies color into styles. Previous seafood grading standards have included color only as a visual indication of deterioration in quality from the normal appearance of a product. In contrast to other graded seafoods, the normal appearance of freshly prepared minced fish blocks can vary widely. These blocks can be made from virtually all species, ranging from white flesh such as cod to dark flesh such as herring, or from a mixture of species. For some product applications, such as fish sticks or portions, a white appearance is desirable (King, 1973a). For other applications such as mixtures with ground beef, a dark appearance is appropriate (King, 1973b).

Such considerations led to classifying styles of color in the Proposed Interim Standards for Grades of Frozen Minced Fish Blocks. The present document (National Marine Fisheries Service, 1975) states that "color standards will be developed and incorporated in the final regulations." Since its publication, we have examined several methodologies for color classification. They are described in this report.

In present buyer-seller contracts, the appearance (color) of minced fish blocks is determined by mutual agreement, such as by limiting the source material which can be used or by using color photographs or chips. These methods have obvious advantages of flexibility and practicality when used by small groups. Their advantages become difficulties when considering them for a proposed U.S. standard. For example, the proposed interim standards of grades of frozen minced fish blocks is meant to include all source materials from which minced fish blocks might be derived. Color photographs have their disadvantages, such as fading and difficulty of duplicating or replacing an original with a

color-correct copy. Color chips or models have been used in grading certain fruits and vegetables, but difficulties in using them or replacing them are being encountered (Agricultural Marketing Service, 1975; Magnuson[1], pers. commun.).

Pictorial color standards have been developed to show frozen beef of acceptable (normal) color and various degrees of brown, dark red, or bleached (whitened) discoloration (Kansas State University, undated). These eleven pictures have been used to visualize beef quality. They are useful in industry since most reflectance spectrophotometers or colorimeters are too unwieldy to use at the several points of frozen beef color evaluation (Kropf et al., 1976). Their usefulness in standardizing color styles is limited. For example, two copies from a single press run were found to have different instrumental tristimulus parameters and sometimes visual differences (Kropf et al., 1976). Further differences in color are expected as copies of these pictorial standards age, but the extent of such changes has not yet been measured.

An instrumental approach to classifying color styles might overcome problems associated with visual judgments. In a series of publications, Little (1969a, 1969b, 1969c, 1972) described an objective method for measuring color characteristics of canned tuna. Her study included measuring variations in instrumental performance against a selected "reference" instrument. It included six instruments and compared three different models against the "reference" instrument. Variations in instrument performance were reconciled by regression analysis techniques, but this method was considered impractical on an industry-wide basis.

Little (1969a) recommended developing material color standards to calibrate each instrument to insure uniform results. These color standards would mimic the color of canned tuna and thus define tuna color in terms of CIE-Y value as determined by tristimulus colorimetry. Although subsequent reports (Little, 1969b, 1969c) describe a chemical treatment for presenting uniformly colored tuna samples to an instrument, the goal of uniform color standards was not achieved. Others have had similar difficulties, for example the Agricultural Marketing Service (1975) and Magnuson (footnote one). The source of these difficulties is related to the chemical dyes used to make such standards. It is possible to make as many sets as desired of a series of uniform color standards when all are based on single mixtures of dyes. However, once these mixtures have been used up, it appears to be impractical to match these sets with another production of color standards.

Difficulties in preparing color standards for instrumental analysis can be avoided by using Munsell neutral value standards. This approach has been used for almost 15 years in the canned tuna standard (Food and Drug Administration, 1962). It requires an optical comparator fitted with a narrow band light filter (550-560 mμ). A sample of canned tuna appears gray when viewed under the specified conditions. Its shade of gray is compared to a Munsell neutral value standard. Each standard's appearance (shade of gray) is identified by a Munsell value between 10 ("pure" white) and 0 ("pure" black). The canned tuna standard defines "white" tuna as not darker than Munsell value 6.3; "light" tuna as not darker than Munsell value 5.3, and "dark" tuna as darker than Munsell value 5.3 (Food and Drug Administration, 1962).

The Munsell neutral value standards described in the canned tuna standard (Food and Drug Administration, 1962) can be replicated uniformly. Each shade of gray is based on page 406 of Newhall et al. (1943) which relates Munsell values to percent magnesium oxide. These standards can be used with reflectance spectrophotometers or with colorimeters. Their "color" does not fade.

The disadvantage of Munsell neutral value standards is that it is difficult to relate a shade of gray to visual appearance of most seafoods. A set of pictorial standards helps one to visualize their appearance even though the pictures lack precision in classifying sample colors, especially those that are close to a previously specified Munsell neutral value.

To illustrate the construction of a color classification system for minced fish blocks, we prepared a series of "white", "light", and "dark" blocks. They were photographed using a "color-correct" process to illustrate a pictorial standard. Their reflectances were measured using Munsell neutral value standards to illustrate objective standards. In this illustration, we also compared frozen, thawed, and cooked samples because each state has advantages and disadvantages for color classification. The frozen state is the normal condition for most uses of fish blocks (e.g., fish sticks and portions). It is also used extensively in grading fish blocks. The thawed state eliminates frost interference with visual or objective measurements, but chemical reactions in a sample during thawing may alter its appearance. The cooked state relates directly to appearance when eaten, but cooking may add a second set of chemical reactions to alter appearance (color) compared to the original frozen state.

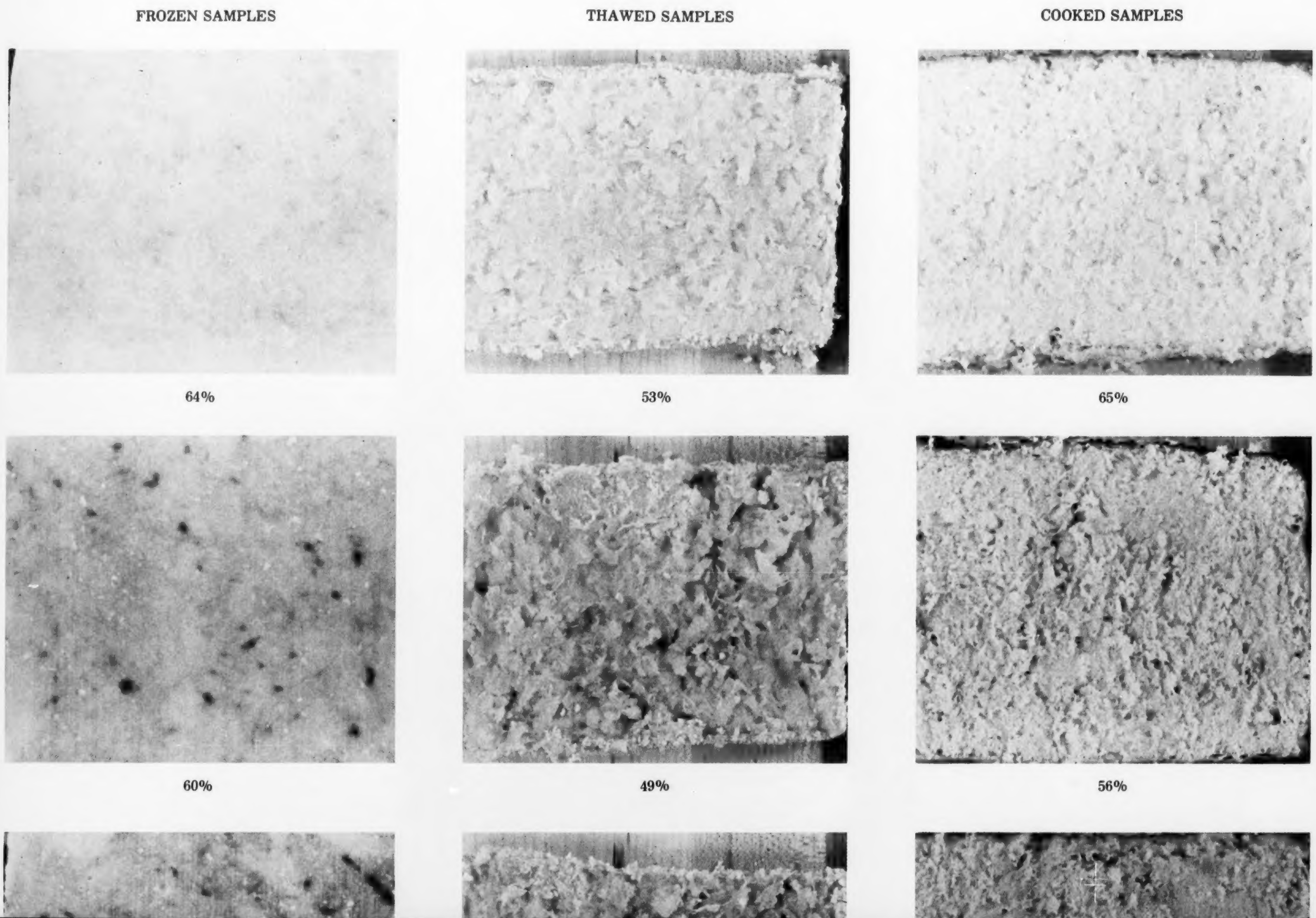
The minced fish blocks were made from mixtures of minced cod ("white") and herring ("dark"). The minced cod was prepared by passing skinless cod fillet flesh ("V-cuts") through a meat-bone separator (King, 1973b). The minced herring was prepared similarly from headed and gutted herring. The mixtures were prepared by weighing the cod and herring components, mixing them thoroughly by hand, and forming 16½-pound blocks using conventional molds in a plate freezer. Portions for the thawed and cooked state measurements were sawed from each block, battered and breaded, then frozen-stored from 1 to 5 days until used. The remainder of the block was used for frozen-state measurements. Thawed portions were held at ambient temperature until defrosted. Cooked samples were deep fat fried (King, 1976) using frozen portions. A serrated-blade meat-slicing knife was used to remove batter-breading cover from one side of thawed and cooked portions.

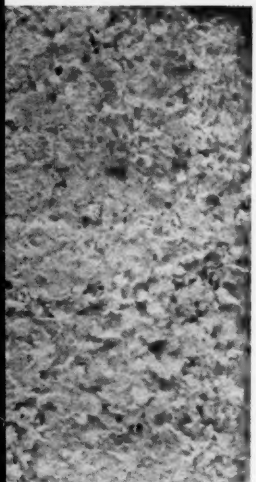
The samples were photographed using Kodak[2] Type L, Ektacolor pro-

[1] Robert M. Magnuson, Magnuson Engineers, Inc., San Jose, CA 95150. 1974. Pers. commun.

[2] Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Figure 1.—Color and reflectance measurements on frozen, thawed, and cooked minced fish block samples. Relative reflectance values are based on full scale calibration of spectrophotometer (0 to 90 percent reflectance).





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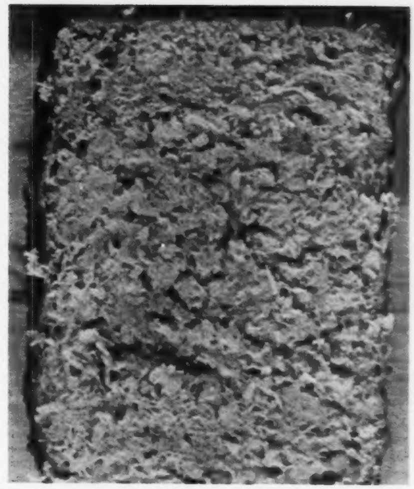

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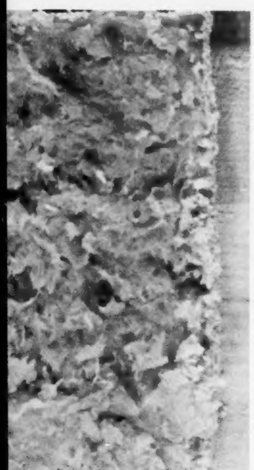

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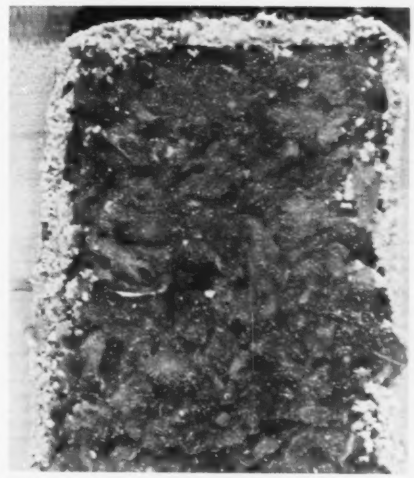

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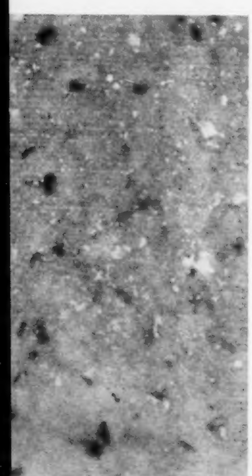

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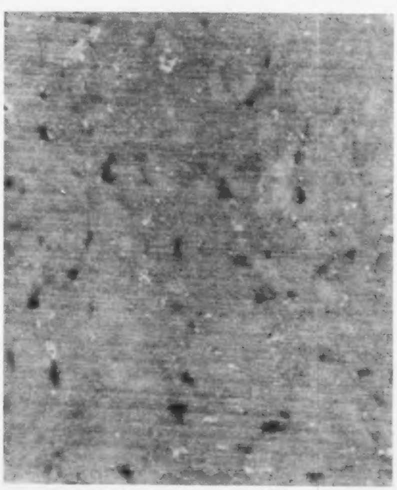

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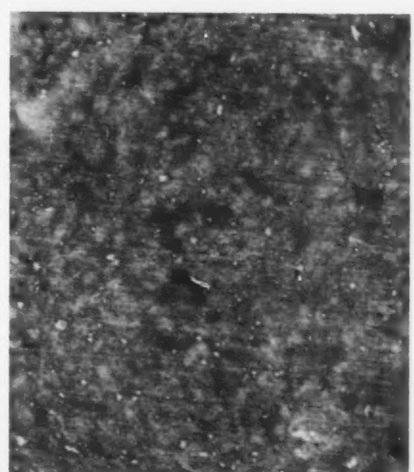

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fessional film, 6102 under Tungsten (3200 K) illumination. Kodak neutral test cards (gray side-18 percent reflectance, white side-90 percent reflectance) were included in each exposure. The negatives were developed by a "color-correct" process based on the appearance of these test cards. Frozen samples were tempered to minimize frosting during the photography.

To measure reflectance, we used an Agtron M-400 spectrophotometer with a M-30-A wide area viewer operated in the red mode (640 mμ). The photometer was calibrated with Agtron mineral pigmented polystyrene discs. The appearance (shades of gray) of these calibration discs and their numerical identifications are based on a Munsell neutral value scale from 0 to 10 as described on page 406 of Newhall et al. (1943). For frozen samples, a sheet of 0.003-inch thick Herculene drafting film (Keuffel and Esser No. 19-1153) was placed frosted side down on the viewer underneath the tempered block sample. For thawed and cooked samples, a Meat Stick Adapter (Agtron No. 20519) with a Positioning Ring (Agtron No. 18379) was placed on the viewer. The thawed and cooked samples covered the 3.25- by 3.50-inch opening of this adapter.

Figure 1 illustrates a color classification system for minced fish blocks using pictures and reflectance measurements. It does not include "break-points" to separate "white" versus "light" versus "dark" color styles. Where to set "break-points" is more of a problem for minced fish blocks than for canned tuna. For example, "white" canned tuna is limited to albacore (Food and Drug Administration, 1962). Other species of tuna cannot be made into "white" canned tuna. In contrast, the scope and product description of the present minced fish block standard allows single or mixed species (National Marine Fisheries Service, 1975). A wide variety of species is available for manufacture of minced fish blocks so one can visualize a virtually continuous range of colors from "white" through "light" to "dark".

Setting "break-points" to distinguish color styles in a minced fish block standard involves agreements between producers and users of the blocks and consumers of products made from these blocks. If this report is useful to discussions on where to set these "break-points", it will have achieved its purpose. In the following paragraphs, we illustrate one way color styles might be classified in a grade standard. This illustration includes "break-points" as well as mention of a specific spectrophotometer and measurements based on cooked samples for purposes of discussion between producers, users, and consumers; no final recommendations are implied.

Add new section at end of standard as follows:

278.7 Appendix 1. Definition and method of measuring color classifications cited in section 278.2(b).

Introduction. Although the method described below is based on an Agtron instrument, any make of reflectance spectrophotometer may be used provided that it can be calibrated with neutral value standards based on the Munsell notation system as defined in terms of the CIE (International Commission on Illumination) standard observer and coordinate system for color specification. This method is based on an Agtron M-30-A Wide Area Viewer, a M-31-A Control Console, and its set of calibration discs (Magnuson Engineers, Inc., San Jose, Calif.) merely to simplify the technical description for users of other makes of reflectance spectrophotometers. Although Agtron calibration discs are numbered to approximate reflectance levels based on Munsell neutral value intervals, the description below uses Agtron designations for simplicity. Other calibration standards may be used if they provide equivalent results when used with a suitable reflectance spectrophotometer. Chip or swatch samples based on Munsell notation and percent reflectance for CIE illuminant "C" can be obtained from Munsell Color, Inc., Baltimore, Md., or made as given by the relationship between Munsell value and luminous reflectance derived by a subcommittee of the Optical Society of America and published in the *Journal of the Optical Society of America*, vol. 33, p. 406 (1943).

Sample preparation. The color of the sample must represent the average color of the block when it is cut from that block. At least one of its sides must be large enough and flat enough to completely cover the spectrophotometer's viewing area. It is cooked by the Bake Procedure or by the Deep Fat Frying Procedure as given in *Journal of Official Analytical Chemists*, vol. 59, no. 1, p. 225-226 (1976). If the sample is covered with batter and breading for cooking, this cover is removed with a sharp serrated knife so that the viewing area surface remains flat. The cooked sample must also be thick enough to prevent transmission of external, ambient light into the viewing area of the reflectance spectrophotometer.

Measurement of color. An Agtron or equivalent reflectance spectrophotometer is used. Its light source and filters are designed to view a sample primarily in the red region of the spectrum, at or near 640 nanometers. The viewing area is at least 6 square inches. Its borders are designed to allow placement of calibration discs or fish samples without entrance of external ambient light into the viewing area.

Definition of "white" samples. Calibrate the spectrophotometer to 0 percent reflectance using a number 00 ("black") calibration disc, then to 90 percent using a number 90 ("white") calibration disc. Place a sample on the viewing area and measure its reflectance. Samples from "white" blocks have a relative reflectance greater than 63 percent; but if a particular sample has a relative reflectance between 56 percent and 68 percent, its reflectance is measured again using an expanded scale before defining it as "white". Recalibrate the spectrophotometer using a number 56 calibration disc to set 0 percent reflectance and a number 68 calibration disc to set 100 percent reflectance on its scale. With these calibration settings, a "white" sample is defined as having a greater relative reflectance than a number 63 calibration disc[3].

Definition of "dark" samples. Calibrate the spectrophotometer to 0 percent re-

[3]A number 63 or a number 53 calibration disc is not presently available as standard equipment for the Agtron M-30-A Wide Area Viewer. Number 63 and number 52 calibration discs are presently available for the Agtron M-30A Spectrophotometer. These discs are much smaller (2.5-inch diameter) than the 6.5-inch diameter discs used with the Wide Area Viewer. We are assuming that the larger discs could be manufactured if a demand existed.

flectance using a number 00 ("black") calibration disc, then to 90 percent reflectance using a number 90 ("white") calibration disc. Place a sample on the viewing area and measure its reflectance. Samples from "dark" blocks have a relative reflectance less than 53 percent; but if a particular sample has a relative reflectance between 44 percent and 56 percent, its reflectance is measured again using an expanded scale before defining it as "dark". Recalibrate the spectrophotometer using a number 44 calibration disc to set 0 percent reflectance and a number 56 calibration disc to set 100 percent reflectance on its scale. With these calibration settings, a "dark" sample is defined as having a lower relative reflectance than a number 53 calibration disc (footnote 3).

Definition of "light" samples. If a sample does not satisfy the criteria given above for "white" or "dark" samples, it is classified as "light".

ACKNOWLEDGMENTS

Paul J. Regan and Dana H. Gordon gave valued technical assistance.

The National Fishery Products Inspection and Safety Laboratory, Pascagoula, Miss., kindly lent us the Agtron reflectance spectrophotometer used in this study.

The Gorton Group, Gloucester, Mass., and Robert W. Hayman, Inc., Bronxville, N.Y., showed us how color photographs might be used for buyer-seller contracts. They and other industrial members of the New England Fisheries Institute have given valued advice on color classification for minced fish blocks.

LITERATURE CITED

Agricultural Marketing Service. 1975. Standards for grades of orange juice. 7 CFR Part 52. Fed. Regist. 40 (145):31607-31609.

Food and Drug Administration. 1962. Definitions and standards of identity; standards of fill of container. 21 CFR Part 37 - fish - canned tuna. Promulgated February 7, 1957, as amended. Reprinted March 1962 from Title 21, Code of Federal Regulations, Part 37.1. Food Drug Admin., Wash., D.C.

Kansas State University. Undated. Beef color. Department of Animal Science and Industry, Kansas State Univ., Manhattan, Kan.

King, F. J. 1973a. Improving the supply of minced blocks for the fish stick trade: a progress report. Mar. Fish. Rev. 35(8):26-32.

__________. 1973b. Acceptability of main dishes (entrees) based on mixtures of ground beef with ground fish obtained from under-used sources. J. Milk Food Technol. 36:504-508.

__________. 1976. Procedures for cooking seafood products. J. Assoc. Official Anal. Chem. 59:225-226.

Kropf, D. H., H. J. Tuma, C. C. Allen, M. C. Hunt, M. L. Sandberg, and D. E. Schafer. 1976. Evaluation of color and other properties of frozen beef. *In* Objective methods for food evaluation. Proceedings of a symposium, November, 1974, Newton, Mass., Natl. Acad. Sci., Wash., D.C.

Little, A. C. 1969a. Reflectance characteristics of canned tuna. 1. Development of an objective method for evaluating color on an industry-wide basis. Food Technol. 23(10):71-74.

__________. 1969b. Reflectance characteristics of canned tuna. 2. The relationship of pigment concentration to luminous reflectance and color evaluation. Food Technol. 23 (11):134-136.

__________. 1969c. Reflectance characteristics of canned tuna. 3. Observations on physical and chemical properties of the pigment system. Food Technol. 23(11):136-140.

__________. 1972. Effect of pre- and postmortem handling on reflectance characteristics of canned skipjack tuna. J. Food Sci. 37:502.

Newhall, S. M., D. Nickerson, and D. B. Judd. 1943. Final report of the O. S. A. subcommittee on the spacing of the Munsell colors. J. Opt. Soc. Am. 33:385-418.

National Marine Fisheries Service. 1975. Frozen minced fish blocks. Proposed interim grades standards. 50 CFR Part 278. Fed. Regist. 40(50):11729-11731.

MFR Paper 1234. From Marine Fisheries Review, *Vol. 39, No. 2, February 1977. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

MFR PAPER 1235

Some Recent Examples of Fishing Gear Technology Development or Transfer in New England

ROBERT E. TABER

Fishing gear development or technology transfer supported by a variety offunding sources is currently being conducted in New England by universities, state fisheries agencies, or nonprofit fisheries corporations. The funding sources for these efforts have, for the most part, been through the New England Fisheries Development Program, local Sea Grant programs, or the Southern New England Fisheries Development Program. The assumption, as well as the intent, is that benefits derived as a result of the efforts in New England would be directly applicable to many segments of the fishing industry throughout the United States.

Following is a discussion of only a few of the technology transfer or development efforts aimed at providing a diversified harvesting capability for coastal fisheries vessels.

SQUID

The squid resources of the northwest Atlantic are one of the few underutilized stocks that are available to fishermen in the Northeast and at the same time are in strong demand by markets on a worldwide basis. Hence, squid has been a logical choice for emphasis under the New England Fisheries Development Program associated with the harvesting, processing, and marketing of this species.

During the spring and summer of 1974, efforts were made to determine the potential of using light attraction methods at night for harvesting of squid similar to the techniques used in the California squid fishery. The observations made were encouraging as evidenced by the recordings of squid in Figure 1. As a result, during the summer of 1975 and spring of 1976, effots were made to purse seine squid at night using light attraction methods. The purse seining technique was believed to be potentially effective

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because of the manner in which the squid reacted to light from May to November of 1974. It was demonstrated that the squid could be concentrated in approximately a 200-foot diameter area around a vessel to a depth of 5 fathoms. However, at no time would the concentrated squid come to the surface so that brailing or pumping techniques could be employed.

The purse seining efforts made in 1975 and 1976 proved unsuccessful for unexpected reasons. During 1975, no squid could be found in the areas where they were prevalent in 1974. In 1976, even though the efforts were made in areas where substantial quantities of squid were confirmed, the squid were not attracted to the identical light source as in 1974.

However, the full objective of the New England Fisheries Development Program includes the development of markets as well as processing and harvesting developments. The marketing efforts are providing a strong incentive to produce squid because of the resultant improved price structure. Interest in squid as a viable resource for a directed fishery has multiplied many times over the previous 2 years. Innovative efforts by fishermen from New Jersey to Massachusetts have taken place with such gear as bottom trawls using 64-inch mesh, pelagic pair-trawls, and bottom pair-trawls. The results of the program and the interest in squid by the Southern New England fishing industry is illustrated in Table 1 which compares the spring landings of 1975 with those of 1976.

HERRING

Pelagic pair-trawling for herring was adopted by the New England industry through the efforts of the University of Rhode Island (URI) Sea Grant Program about 5 years ago. Since that time the method has been adopted by vessels from Cape May, N.J., to Boothbay Harbor, Maine, with interest also developing on the possibility of bottom pair-trawling. Funding from the Southern New England Development Program has enabled the URI Marine Advisory Service to successfully introduce this technique to further extend the capability of vessels fishing for herring, mackerel, and other pelagic or semipelagic finfish. The primary purpose for introducing the trawl was to enable pelagic pair-trawling vessels to continue fishing on herring when the herring went to the bottom as their mid-water trawls are not capable of fishing on the bottom effectively. Hence, in these instances, the bottom pair-trawl can change many unproductive nights into productive ones. Since its introduction during the spring of 1976, three pairs of vessels have adopted this additional capability. Interest has also been expressed in trying this method offshore for species such as squid, mackerel, or butterfish.

The trawl is illustrated in Figure 2 and is referred to as a two-bridle Bleakspruttetrawl. It is a modified version of three-bridle Bleaksprutte-trawl which is a symmetrical two-piece trawl with wedge pieces in the sides and utilizes 32-inch stretched mesh size in the face. The trawl is rigged with a 2-inch rubber disc sweep and towed in a similar manner as a mid-water pair-trawl with no floats on the

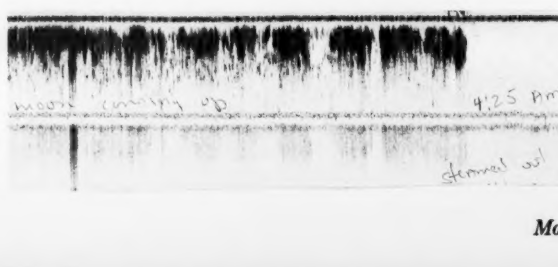

Figure 1.—Recording of squid from the *Mari - Gale - Barbara*, 13 August 1974, 6 miles south of yellow hills on Martha's Vineyard in 14 fathoms with four 1,000-watt lights on.

Table 1.—Maine and Rhode Island squid landings, average price, and value, April-June 1975 and 1976.

Year	Landings (lb)	Average price (cents/lb)	Value ($)
1975	639,550	14.6	93,845
[1]1976	4,000,000	0.23	920,000

[1]Based on preliminary estimates.

headline except for a couple of polyform buoys which assist in the hauling and shooting but provide little, if any, flotation while fishing. With the trawl rigged in this manner, a headline height of between 5 and 7 fathoms could be achieved with two vessels of 350 horsepower each. The trawl introduced was 300 meshes around, of 32 inch in the bellies, and with a top and bottom hanging line length of 180 feet.

The method described above has been successfully used by the coastal vessels in Britain for fishing in extremely rough bottom areas for cod and haddock. Although the trawls used are not quite the same, the technique of bottom pair-trawling has allowed both fleets to extend their capability and effectiveness in becoming more competitive. It is this increase in competitiveness which in some measure will assist the New England fishing industry to harvest a greater percentage of the stocks from America's coastal waters.

HARVESTING TECHNOLOGY

Some of the current efforts on harvesting technology involve joint funding from two programs in conjunction with the industry. An example of such a project currently underway is the underwater video taping of trawl gear being supported by URI and the Southern New England Fisheries Development Program.

Fishermen have had the desire and need to look at their towed gear ever since towed gear was first used. Divers and/or transducers have been used with some success but, unfortunately, it is usually true that fishermen don't dive and divers don't fish.

Hence most, if not all, of the information obtained in the past is either of a "hearsay" nature or an electronic interpretation of a trawl under test which is of course better than no information but still remains incomplete. It is the purpose of this project to enable fishermen from Maine to New Jersey to view their own towed gear and begin to answer some of the questions that continually persist.

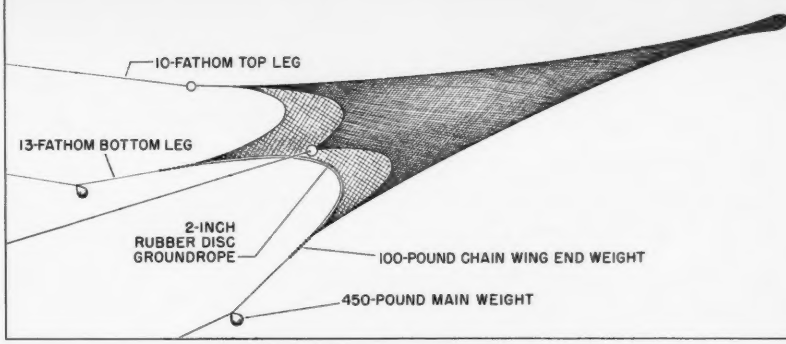

Figure 2.—Two-bridle Bleakspruttetrawl.

There are three primary uses for the information obtained from this project: 1) it allows individual fishing skippers to evaluate their own towed gear as they have it rigged, and lets them make "demonstrated" adjustments to improve the gear's efficiency and productivity, 2) it gives trawl builders and designers the oppportunity to study and evaluate the dynamics of trawl design and rigging on a full scale working basis, and 3) it provides invaluable teaching tools in upgrading the level of knowledge of our existing skippers as well as students in formal fisheries training programs.

The University of Rhode Island has constructed a specially designed 26-foot aluminum boat with a 40-foot mast. An underwater TV camera is mounted on the mast which is then suspended below the boat during operation. The boat can control its position relative to the vessel whose trawl is being videotaped.

The electronics and the operational costs of this project are being funded by the Southern New England Fisheries Development Program while the boat was provided by URI. The fishing industry is supplying the vessels and trawls to be videotaped.

A fourth project of interest involves the conversion of a 36-foot Chatham, Mass., longliner that traditionally fishes for haddock and cod to Danish or Scottish seining for sanddabs. The equipment and gear is currently on order with the fishing demonstration scheduled for the months of March through June of 1977. The vessels fishing from Chatham have been exclusively longliners for many years. During the last few years the fleet has numbered as many as 70 vessels with only about 25 percent of the vessels operating on a profitable basis. Hence, there is a true and serious need for the fleet to diversify with interest in the success or failure of the project being readily evident.

There are numerous other fishing technology projects known generally throughout New England, which are currently underway in the region. These include a safer and more efficient hook-up block being developed by the MIT Sea Grant Program, lobster bait bagging and mussel harvesting projects of the New England Fisheries Development Program, and trawl and trawl door developments at URI. The direction of these developments and their implementation are augmented by the cooperation and informal coordination which exists between all of the agencies, programs, and groups involved in fisheries development. The results of these projects and the cooperation of the various interests have begun to pay off in real dollars for the fishing industry in recent years. This trend should continue in the future and become a key factor in the management and exploitation of our fisheries resources as the United States moves forward under the guidance of the regional management councils.

MFR Paper 1235. From Marine Fisheries Review, *Vol. 39, No. 2, February 1977. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

MFR PAPER 1236

McAvoy

Export Opportunities for New England Fishery Products

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INTRODUCTION

Extended jurisdiction has placed an additional 2 million miles of ocean and about 20 percent of the world's fishery resources under U.S. control. Henceforth, Regional Management Councils will mandate allowable catches for resources that fall under U.S. jurisdiction and will allocate those catches to U.S. and foreign fleets. United States allocations will be based on the harvesting capacity of the U.S. fleet.

It will take years for the United States to build to the offshore fishing capability of foreign fleets. Foreign fleets now take over 90 percent of the fish harvested in the 12-200 mile zone, while the U.S. fleet expends 95 percent of its effort inside 12 miles. It is clear that there will be foreign fishing activity in U.S. waters for some time to come.

Extended jurisdiction should revitalize depleted resources and strengthen the overall economy of the fishing industry within 5 - 10 years. Short-term benefits are less apparent. However, in our opinion, the New England fishing industry can begin to realize significant benefits immediately by gradual expansion of fisheries for several species that are now fished heavily by foreign fleets off the New England coast. There are large markets for some of the so-called "under-utilized" species in Europe and Asia, and foreign buyers are already seeking New England suppliers. Fortunately, the New England industry has been laying the foundation for expansion of these fisheries for the past 3 years.

PROGRAM UNDERWAY

In 1973, when the hope for extended jurisdiction was dim and confidence in the future of the New England fishing industry was very low, NOAA-NMFS and the New England fishing industry started the New England Fisheries Development Program (NEFDP). Cod, haddock, and other valuable northwest Atlantic species had been seriously overfished during the 1960's. This had disrupted the economy of the industry, caused a disastrous decline in total landings, and reduced the size of the fishing fleet. Industry acknowledged the potential of latent species, but requested assistance to solve the harvesting, processing, and marketing problems that these species presented. The NEFDP was established to provide that assistance.

NEFDP developmental projects are tailored to the problem areas in each species' fishery and include activities such as: reviews of existing data on resource availability and harvesting technology to establish availability and optimum catch rates; development of mass handling and sorting methods for vessels and shore plants; investigation of processing technology and product engineering problems as necessary to permit efficient manufacturing of traditional as well as new products; and studies to ascertain the market potential of the species here and abroad.

NEFDP TARGET SPECIES

The NEFDP has a 5-year plan to increase New England catches of six target species. The following tabular data shows the 1976 total allowable catches (TAC's) and U.S. allocations for the target species in a management area fished by New England vessels. The table reveals that, at this time, foreign fleets have 81 percent of the TAC's for target species in this particular area. This illustrates the tremendous potential for expansion of these fisheries. As stated earlier, as U.S. capability increases foreign fishing will be phased down.

A retail fresh fish market in Milan, Italy. There is a strong preference for fresh fish throughout Italy. Various species arrive in Milan daily by truck, rail, and air.

Species	Metric tons	U.S. quota 1976
Squid	74,000	6,000
Whiting	103,000	27,000
Herring	50,000	15,400
Mackerel	254,000	5,200
Red Hake	42,000	7,000
Misc. Species	150,000	68,000
Total	673,000	128,600

Prospective European buyers sample New England underutilized products at the Milan Trade Show sponsored by the New England Fisheries Development Program, April 1976.

EXPORT OPPORTUNITIES

The NEFDP is working to expand domestic markets for the target species as well as for eels, mussels, skates, offshore crabs, and ocean quahogs. However, these species are relatively unfamiliar to the American public and progress will be slow. European or Asian consumers are probably no different in their attitude toward new and different products, but because of their ethnic backgrounds, fishery products are much more favored on the menu. Therefore, the prospect for rapid expansion of foreign markets for some of these species is infinitely more promising.

The enormous foreign fisheries for the NEFDP's target species off the New England coast testify to the popularity of these species in Europe and Asia. User countries are uncertain what effect extended jurisdiction will have on their future supplies and they are obviously concerned. Indeed, shortly after the Fishery Conservation and Management Act of 1976 was passed by Congress, foreign buyers began contacting fishery firms along the eastern seaboard to inquire about their future production plans. These direct contacts, the increased exports of some of the target species in recent months, the results of a European study conducted by the NEFDP, and reaction to the target species at a European food show in April 1976 confirm that the New England fishery has a real opportunity to increase its foreign trade.

Street sales are common in coastal cities, such as pictured here in Vigo, Spain. The per capita consumption of fish in Spain is over 30 pounds per year.

EUROPEAN MARKET STUDY

In 1975, the NEFDP financed an illuminating study of Western European markets for squid, whiting, dogfish, mussels, skate wings, and monkfish (anglerfish) tails. The study report provided information on imports and exports, consumption, and market form preferences on each species, by country. The report also gives general country specifications for each species. The report is most comprehensive and we will not try to summarize the very specific information it contains in this paper. However, we can convey the general message of the results.

The report concluded that there are large potential markets for New England squid and whiting and somewhat smaller but significant markets for the other species included in the study in Western Europe. It points out that West European buyers are extremely skeptical about the ability and desire of U.S. firms to supply the quantity and quality of fishery products demanded by the European market. Past performance of U.S. firms has been generally poor. However, European companies are very concerned about

Early arrivals inspect cod for freshness at the Hull, England, wholesale market. Most of this fish comes from Icelandic waters and is sold daily at auction.

future supplies and are eager to do business with New England producers. The foreign buyers interviewed cautioned New England companies that they must be prepared to ship quantities ordered, and shipments must be made on schedule. Furthermore, producers must understand that shipments that fail to meet quality and grade specifications will be rejected. They should also expect to encounter strong domestic and third country competition in terms of quality and price. Foreign buyers do not feel that the obstacles to rapid expansion of trade are insurmountable.

MILAN INTERNATIONAL FAIR

Two representatives of the NEFDP displayed underutilized species and interviewed hundreds of European buyers at the 52nd annual Milan International Fair in Milan, Italy, 14-23 April 1976. The NEFDP exhibit was located in the U.S. Trade Center, a permanent facility on the Milan Fair grounds that is operated year round by the U.S. Department of Commerce. Over 3 million people toured the enormous fair during its 10-day run. Several hundred food buyers visited the fishery products exhibit, and a majority of them expressed interest in importing one or more of the products.

Only one New England producer attended the air. This was unfortunate. Producers of several of the products would have had opportunities to close numerous transactions on the spot. However, the representatives were able to answer hundreds of questions, and they gave price information that had been furnished by producers.

Fourteen seafood companies sent products to the fair. The display featured round long-fin and short-fin squid, round whiting, frozen eels, monkfish tails, canned herring, minced dried salted cod, red crab meat and red crab knuckles, flounder roe cubes, breaded dogfish portions, skin-on and skinless dressed dogfish, breaded mussels, and other products that were not of direct interest to the New England industry.

As expected, squid and whiting were the most popular products. The European study had established that squid and whiting are major consumption items in Italy and other Mediterranean countries. Italian buyers expressed a strong preference for long-fin squid, *Loligo pealei*, while Spanish and English buyers were prepared to purchase great quantities of both long-fin and short-fin, *Illex illecebrosus*, squids. There was strong interest in frozen eels, monkfish tails, and dressed dogfish; moderate interest in the other products.

Upon returning to this country, the NEFDP representatives disseminated the names, addresses, telephone numbers, and telex numbers of several dozen interested European buyers. An industry seminar was conducted in Boston to report the results of the fair. Experts in the technical aspects of exporting were present to acquaint industry members with exporting procedures.

As a result of this effort, exports of squid have increased steadily in the past few months. More importantly, numerous firms have established contact with foreign firms and New England firms have sent representatives to Europe to meet with buyers. Interest in exporting is definitely on the rise.

QUALITY FOREMOST

Under extended jurisdiction, foreign fishing will decrease as U.S. harvesting capability increases. New England has the opportunity to increase exports of certain "underutilized" species fairly rapidly and should serve as the incentive to develop this fisheries provided certain shortcomings are overcome. The lack of experience in processing nontraditional species to European quality standards is the main disadvantage. European consumers are fresh fish oriented, but inadequate supplies have forced consumers to accept frozen products as "next best" provided that most of the "fresh" quality has been preserved. As a result, many species of fish are processed and frozen at sea aboard factory vessels. European importers are quite aware of fish processing and handling practices as they are carried out by our industry. They are somewhat skeptical about our ability to produce the quality required for their markets. They know, for example, that our vessels ice their catch and process them after landing. This practice may be acceptable for some groundfish species, but raises some eyebrows with regard to other species, squid for example.

In order to overcome the generally poor reputation that exists in Europe for New England products, processors will have to familiarize themselves with the quality and grade standards required. Strict adherence to these

standards must be maintained for continued and lasting relationships.

PROCEED WITH CAUTION

Most New England fish processors represent small firms. They are accustomed to dealing with other individuals or companies conveniently accessible to them. The type of pack, quality of the product, method of shipment, and terms of payment are usually understood by buyer and seller. Exporting, on the other hand, is much more complex. Often buyer and seller have never met. Misunderstanding about species, quality standards, and terms and method of payment can arise.

Prices of certain fishery products can often be misleading. As an example, during the spring of 1976, representatives from Spain and Japan, as well as U.S. brokers, were traveling up and down the East Coast attempting to purchase squid. Price information was confusing but seemed to vary considerably from $0.45 to $0.75 per pound. The difference probably reflected the quality of the pack. This type of activity could lead to serious consequences in the future. Overzealous processors attracted by apparently favorable prices may find themselves with excess inventories, packed on speculation for markets that do not materialize. This could be caused by a number of factors. Third country competition could affect the price structure, for example. A domestic fleet supplying the total need of the country or changes in a country's eonomical situation regarding balance of payments could also affect U.S. exports.

COLLECTIVE INDUSTRY PARTICIPATION

Exporting fishery products can be a profitable business. Certainly vast overseas markets exist for high quality fish and shellfish now, with greater promise for the future. In some instances, importers requiring hundreds of tons of certain species have been identified; orders much too awesome for most domestic producers to fill. It might be well for the New England industry to consider organizing into an association to collectively represent their interest in exporting fishery products. Members within this association would have knowledge of the mechanics of exporting as well as up-to-date information on the availability of products to export. Thorough knowledge of markets and price information could be gathered and used to predict the outlook for certain species in certain countries. Information on packing requirements and quality standards would be sought from foreign importers and established as criteria for U.S. processors to adopt. Establishment of such an association could provide small processors market opportunities for diverse species that he otherwise would be reluctant to undertake on his own.

MFR Paper 1236. From Marine Fisheries Review, *Vol. 39, No. 2, February 1977. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

National Marine Fisheries Program Unveiled

A sweeping, long-term program to conserve and develop the Nation's marine fisheries was announced late last year by then Secretary of Commerce Elliot L. Richardson. The program, unique in the history of U.S. fishery management, is designed to bring a major national resource to a new state of health and productivity, and to benefit consumers and industry in the process.

Secretary Richardson, hailing the comprehensive plan, indicated that it had come at a vital time. Warning that overfishing off U.S. coasts has seriously depleted approximately 20 species and threatened others, Secretary Richardson said, "we cannot permit the depletion of fish stocks and the destruction of fish habitats to continue. We must learn to manage this resource . . . and we must do it in ways compatible with the Nation's need to develop other valuable uses of the ocean."

The program has four major goals: 1) restore and rationally use important fisheries, 2) develop and maintain a healthy commercial fishing industry, 3) improve marine recreational fishing, and 4) ensure adequate consumer supplies of wholesome seafood.

The program will go into effect gradually over the next 5 years. The National Oceanic and Atmospheric Administration's National Marine Fisheries Service will take the lead in carrying it out, with major roles to be played also by the Coast Guard, Departments of State and Interior, the Environmental Protection Agency, the States, and regional organizations.

The effort was announced as legislation providing a 200-mile fishing limit, officially known as the Fisheries Conservation and Management Act of 1976, approached its effective date of March 1977. Then, the U.S. will manage approximately one-tenth of the world's fish supply; the program is designed in part to facilitate that task. The Federal government will act in partnership with coastal states and Regional Fisheries Management Councils established under the Act.

The paramount concern is the preservation and enhancement of fish stocks, some of which have declined drastically in recent years. To meet this concern the Department will integrate its management efforts, give all possible assistance to the Regional Councils, establish a permit and fee system for foreign fishermen, develop enforcement procedures, participate in negotiations with foreign governments, and step up research.

The total impact on commercial and

Three Named to Top Positions in NMFS

Appointments to three key positions created in a recent reorganization of the National Oceanic and Atmospheric Administration's National Marine Fisheries Service have been announced by Robert W. Schoning, NMFS Director.

Winfred Meibohm, formerly Staff Assistant to Schoning, has been named Associate Director, charged with supervising the day-to-day operations, executing policy decisions, and allocating NMFS resources, according to Schoning.

Brian Rothschild has been appointed Director of the Office of Policy Development and Long Range Planning. This office will coordinate policy development; develop theories, techniques, and procedures to achieve fisheries management to protect fisheries stocks; and predict the impact of complex fisheries decisions.

Kenneth Goodwin becomes Director of the Office of Program Planning, Budget, and Evaluation which will advise the Director on the selection of goals, objectives, and measures of accomplishment and coordinate the development of program plans and budgets to meet objectives. The office will perform and coordinate program analyses, reviews, and evaluations required for program emphasis and resource allocation decisions.

Meibohm retired from the Air Force in 1968, with 27 years service, taught Political Science at Elon College in North Carolina, and joined NMFS as Staff Assistant to the Director in 1972. He received an A.B. degree from Guilford College in 1941, an M.S. degree from George Washington University in 1965, and has done additional graduate work at the University of North Carolina.

Rothschild previously was the Center Director of NMFS's Southwest Fisheries Center in La Jolla, Calif. He has served in numerous positions in NMFS and the Bureau of Commercial Fisheries, and was a Professor of Fisheries at the University of Washington. He received a B.S. degree from Rutgers University in 1957, M.S. from the University of Maine in 1959, and his Doctorate from Cornell University in 1962.

Goodwin previously served as the Chief, Plans and Policy Development Staff. He has held numerous positions in the Federal Government and in private business, transferring to NMFS in 1972 from the Federal Communications Commission. He has a B.S. degree from Yale University and has attended the University of Maryland, American University, and George Washington University.

recreational fisheries is estimated at about $10 billion in annual economic activity. The Commerce Department expects the new program eventually to boost this figure by another $1.5 billion.

Management of resources is only the starting point. The program will seek legislative change to bring fuller coverage of marine fisheries values in environmental decisions, initiate closer environmental review procedures, increase habitat research, cooperate with other agencies toward habitat protection, and assure that plans made under the Coastal Zone Management Act adequately consider living marine resources.

Working with industry and regional advisory groups, the Department will design programs for development of a selected number of fisheries. It will investigate ways to strengthen the ability of private industry to grow on a self-generating, self-sustaining basis. It will seek re-legislation of the Fisheries Loan Fund and use other governmental devices for encouraging private capital to finance and build ships.

The Nation's 30 million recreational fishermen, who caught approximately 1.6 billion pounds of fish in 1970, will receive substantial consideration. Their interests will be taken into account in stock assessment and research programs, in the review of management plans, in the operation of the Coastal Zone Management Act, and in surveys on which further plans can be based.

Existing aquaculture research and development efforts by the National Marine Fisheries Service and the National Sea Grant Program will be increased, with a view to providing a better basis for industry operations, for accelerating the application of research results, and attacking long-range physical problems of currently-farmed fish and shellfish.

Finally, the Department, already busily involved in safety and quality control, will refine procedures, support legislation and programs to protect stocks from chemical pollution, and carry out a national campaign to inform consumers and industry about the factors affecting safety and quality, and of the meaning of Federal identifying marks.

The program will bring a moderate increase in Commerce Department expenditures. In Fiscal Year 1976, the Department spent approximately $76 million on fisheries management and related activities; this year, with the extension of our fisheries jurisdiction, approximately $100 million is contemplated.

Costs are expected to be offset to some degree by fees paid to the general treasury by owners and operators of foreign fishing vessels for permits to catch fish within the 200-mile conservation zone.

Secretary Richardson characterized the program as "only a beginning." Noting that its execution will require careful thought and hard work, he said the Commerce Department will look to the Regional Fishery Management Councils, state governments, the commercial fishing industry, recreational fishermen, scientists, conservationists, environmental organizations, and others for advice and assistance.

Copies of the report, "A Marine Fisheries Program for the Nation," may be obtained from the National Marine Fisheries Service, Washington, DC 20235.

Juhl Named U.S. Fishery Attache to Latin America

The appointment of Rolf Juhl, Laboratory Director of the Southeast Fisheries Center in Pascagoula, Miss., to the post of U.S. Regional Fisheries Attache for Latin America has been announced by the National Marine Fisheries Service.

As Fisheries Attache, Juhl will be responsible for covering fishery developments in Latin America. He will have a special responsibility to act as a liaison between the United States and Mexico regarding tuna, shrimp, snapper, grouper, and spiny lobster fisheries. He will be assigned to the U.S. Embassy in Mexico City.

Juhl

Since 1973, Juhl has been manager of the Groundfish Program of the Southeast Fisheries Center, an element of the National Oceanic and Atmospheric Administration. For 6 years before that, he was a consultant to the Commonwealth of Puerto Rico's Department of Agriculture and Coordinator of the Fisheries and Development Program, funded jointly by Puerto Rico and the United States. Earlier, he was with the U.S. Department of Interior's Bureau of Commercial Fisheries, and also the Inter-American Tropical Tuna Commission, La Jolla, Calif. A native of Santurce, Puerto Rico, Juhl holds a B.S. degree in commercial fisheries from the University of Washington in Seattle.

Tennessee, Arkansas Sign Cooperative Fishery Product Inspection Pacts

Cooperative agreements to inspect fish and fishery products in Tennessee and in Arkansas were signed recently by State representatives and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS).

The voluntary, fee-for-service program encourages and assists the fish industry in improving and maintaining the quality and safety of its products through inspection and standardization procedures usually carried out by Federal inspectors.

These agreements permit existing State food inspectors to be trained and cross-licensed by NMFS, an element of the Department of Commerce (USDC), so they can perform inspections of fishery plants and products on NMFS's behalf within their respective States. The cross-licensing approach makes inspection services more readily available to the trade and more inspected products available to consumers.

"During our inspections, special attention is given to wholesomeness, proper species identification, and quality in either fresh or processed fish products," Tom Billy, Seafood Quality and Inspection Division Chief, said. "We also concern ourselves about problems of excess breading and short weight products to assure the consumer that what he purchases contains what the label indicates," he added.

Inspection of fish products over the past 2 years has encouraged better plant sanitation as well as improved processing and quality control procedures. "More research is needed, however, to fully understand the effects of fluctuating temperatures during transit and storage, from the time it leaves the processing plant, until the time it is removed from the consumer's refrigerator to be eaten," Billy continued. "The impact of these fluctuations on the physical and chemical properties of seafood and breading mixtures is another area needing further investigation."

Other States are expected to sign similar cooperative agreements so that more USDC-inspected products will be available to consumers.

NOAA Moves to Set Fish Name Standards

The National Oceanic and Atmospheric Administration (NOAA) is moving towards bringing order out of confusion at the local fish market to make fish buying less confusing for consumer. While few, if any, consumers would mistakenly buy lobster when they really want salmon, can the same be said for most varieties of fish? Do consumers know, for example, what type of fish to expect when they buy "perch?"

From a marketing viewpoint, NOAA has learned, many seafood names are often misleading and fail to provide consumers with the basic information they need to make a wise purchase. With hundreds of different commercial species and an enormous variety of seafood products such as fish sticks, fish cakes, pâtés, and the like available worldwide, is it any wonder confusion is widespread?

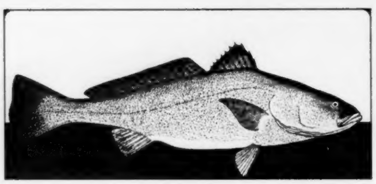
NOAA's National Marine Fisheries Service is implementing a recommended long-range effort to develop a national retail identification system for fishery products; to find and standardize acceptable market names for use by consumers, industry, and regulatory agencies. The first step will be carried out by Brand Group, Inc., of Chicago, a marketing research firm. Under a $59,150 contract, characteristics such as taste, smell, quality, and appeal will be identified for commercial finfish.

A chart listing the species of fish and their characteristics will be developed to permit a comparison of traits. Fish with similar features will be grouped accordingly. Representative groups of similar fish will then be selected from the sorting study, and a model retail identification plan will be developed. Between 150 and 200 finfish and a sampling of shellfish will be included. Representatives of consumer groups, industry, and regulatory agencies will be shown the model plan and asked to evaluate and comment on it.

Requiring 3-5 years to complete, the effort is based on recommendations included in a 1975 feasibility study, "Retail Identification Plans for Fishery Products."

Totoaba, Hawaiian Monk Seal Called Endangered

The totoaba, or MacDonald weakfish (*Cynoscion macdonaldi*), a marine finfish found only in Mexican waters, is in danger of becoming extinct and may be placed on the endangered species list, according to a proposal by Robert W. Schoning, Director of the National Marine Fisheries Service, and Lynn A. Greenwalt, Director of the U.S. Fish and Wildlife Service.



Found only in the northern Gulf of California and most often encountered in the general vicinity of San Felipe, Mexico, the totoaba spawns at the mouth of the Colorado River. The range of the totoaba includes the waters of the Gulf of California from the mouth of the Colorado River to the Rio Fuerte, Sinaloa, on the eastern coast, and from the Colorado River to the Bay of Concepcion, Baja California, on the western coast. The United States has been the principal export market for this fish, which is popular in Southern California restaurants.

Scientists from NMFS, the Smithsonian Institution, the University of Arizona, and elsewhere contributed to the totoaba status review which led to the determination that the totoaba should be listed as an endangered species in support of protective measures taken by Mexico.

The proposal that would list and protect the totoaba as an endangered species throughout its range, is issued under the authority of the Endangered Species Act of 1973.

The Hawaiian monk seal, in danger of becoming extinct, has been placed on the endangered species list, according to Robert W. Schoning, Director of the National Marine Fisheries Service, and Lynn A. Greenwalt, Director of the U.S. Fish and Wildlife Service. The listing, which designates the Hawaiian monk seal (*Monachus schauinslandi*) as an endangered species throughout its range, is issued under the authority of the Endangered Species Act of 1973.

Found throughout the Hawaiian Archipelago, the Hawaiian monk seal breeds only on the islands of the Leeward Chain, including French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, and Kure Atoll.

A status review undertaken by NMFS, a Commerce Department agency, reflects the rarity of the species, the high mortality in pups, the relatively low reproductive rate, and indications of population decline and harrassment. The Marine Mammal Commission and its Committee of Scientific Advisors agreed with the status review and recommended the species be listed as endangered.

The Hawaiian monk seal recently was classified as depleted under the Marine Mammal Protection Act of 1972, but it is believed that by listing the seal as endangered, a higher level of protection may be afforded.

ICELAND CHARTS FISHERY DEVELOPMENTS

Iceland is a country totally dependent on its fishing industry, and the status of its fish stocks is thus of paramount importance. In 1974, fishery exports constituted 75 percent of the country's total exports. The Regional Fisheries Attache for Europe, Norman L. Pease, visited Iceland last summer and prepared the following report on Icelandic fish stocks.

FISH STOCKS

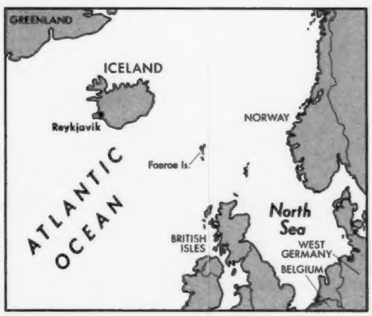
Iceland's most valuable fish stock is the cod, although haddock, saithe, red fish, flatfish, capelin, Norway pout, and herring contribute significantly to the total catch. The cod stock in Iceland's waters comes from two sources: cod of Icelandic origin and mature cod from Greenland which migrate to the Iceland grounds for spawning. On the average, about 25 percent of mature east Greenland cod have migrated annually to Iceland. Fluctuations occur in this stock in accordance with the size of the year classes. Records indicate that during a period of the 1930's, up to 60 percent of the cod tagged at Greenland were récaptured in Icelandic waters. This also occurred in the 1950's, and during both of these periods the cod catch in Icelandic waters was over 500,000 metric tons (t).

Because of the current poor state of the Greenland cod stocks, migration has been minimal in recent years and is not expected to improve appreciably in the immediate future. In addition, the fishing effort has increased with the result that more of the catch is made up of immature fish.

MAXIMUM COD YIELD

It is believed that the maximum yield from the cod stock could reach 500,000 tons per year, if the following steps were taken: 1) reduce current fishing efforts by one-half; 2) prohibit fishing for cod younger than 3 years old; and 3) substantially reduce the catches of 4-year-olds.

Implementation of these steps can be accomplished in several ways. First, there is general acceptance that the number of fishing vessels will be reduced either by selective government intervention or because of natural attrition as fish stocks decline. This will produce economic hardships but appears to be inevitable. Several suggestions have been made to implement a reduction in the fleet. The most acceptable seems to be a new vessel tax, based on gross tonnage, which the government feels will force inefficient vessels out of the fishery. Another proposal will restrict the size of vessels to within specified tonnages. This latter proposal is aimed at the larger (over 1,000 GRT) of the fleet's stern



trawlers which, because of the extended length of their trips, sometimes land cod of substandard quality. To date, no definitive action has been taken on these proposals.

Another method of improving stocks is to close certain coastal regions to fishing, either permanently or at specific times of the year. In this connection, the Icelandic parliament on 5 May 1976 passed legislation which will permit the Ministry of Fisheries to regulate the opening and closing of fishing grounds based on the results of their scientific research.

A third method would be to enforce stricter regulations on the mesh size in the cod end of trawls. Present proposals are to increase mesh from 135 mm to 155 mm. Icelandic fishery inspectors have found both foreign and Icelandic vessels with a small mesh liner in their 135 mm cod ends. An increase in mesh size will permit a regulation to increase the minimum size of cod from the present 43 cm to either 45 or 50 cm.

Finally, the Icelanders want absolute control over the fishing effort of foreign vessels. By summer 1976, agreements had been negotiated with West Germany, Norway, Faeroe Islands, and Belgium. In each instance the cod quotas were considerably reduced from their respective past catches. An announcement on 2 June 1976 of a negotiated settlement between Iceland and the United Kingdom brought the end to their so-called "Cod War". This agreement now effectively brings all Iceland's marine resources firmly under their control.

All evidence indicates that a reduced cod TAC (total allowable catch) for the next few years is essential to the recovery of the stocks. A TAC of 230,000 t has been set for 1976; if this is not followed and the 1974 catch of 340,000 t continues, a drastic decline in stocks, which could undermine the Icelandic economy, could occur by the late 1970's or early 1980's. A TAC of around 280,000 t would be beneficial, but could prolong the recovery of cod stocks up to 10 years.

HADDOCK LANDINGS

Haddock landings have fluctuated widely over the years. This has been due to changes in fishing effort and the rate of recruitment. During the years 1928 to 1937, landings decreased from 60,000 t to 28,000 t. World War II interrupted fishing operations, allowing haddock and other demersal species to recover, but increased fishing after the war soon caused over-exploitation. In 1952 Iceland closed many important nursery grounds to trawling. Haddock stocks soon began to recover and, together with an increase in mesh size and very good recruitment in 1956 and 1957, the catches rose to a peak of nearly 120,000 tons in 1962. Since then, the landings have diminished to 45,000 t in 1974. It has been estimated that the maximum sustainable yield (MSY) of haddock is about 70,000 t. Further reduction in the stock will occur if the fishing effort is not reduced immediate-

ly. Therefore, Icelandic scientists have recommended some reduction in effort and a catch quota of 38,000 t in 1976.

Pollock catches have also fluctuated, from an initial peak of 118,000 t in 1948, down to 47,000 t in 1960. Another upswing occurred in 1971 when 134,000 t were caught. By 1974 the catch decreased to 97,000 t. The MSY isnow estimated at 100,000 t and scientists have recommended a TAC of 75,000 t in 1976. There are three causes for the variations in the quantity of those stocks: 1) changes in the year- class strength, 2) changes in effort, and 3) migratory behavior of the species.

Tagging experiments off Iceland, Norway, the Faeroe Islands, and in the North Sea have shown that immigration of pollock from Norway and the Faeroes takes place, at times on a substantial scale. Emigration from Iceland also occurs. The peak production years mentioned above coincided with a large immigration of stocks to Iceland.

The capelin is the most important pelagic species in the Icelandic fisheries today. In 1974 the landings amounted to 462,000 t and scientists indicate only about 10 percent of the spawning stock is being fished. Although the stock is not fully exploited, it has a short life-span with great annual variations in yearclasses. Scientists recommend caution with this species for now and a fishery is not permitted for immature capelin.

Three herring stocks occur off Iceland. These are identified as summer spawning stock, spring spawning stock, and the adults of the Norwegian spring sprawning herring which have migrated to Iceland. Due to over-exploitation, all herring fishing was stopped in 1971 except for a small drift net fishery. By 1976, the summer spawning stock showed some signs of recovery and a catch of 12,000 t (possibly to be doubled if condition of stocks warrant) will be permitted in 1976. The spring spawning stock and the Norwegian herring unfortunately have still not shown any signs of recovery nor does any seem possible in the immediate future.

EC TRADE PROTOCOL

Following the British/Icelandic agreement about the cod fishery off Iceland, the European Communities (EC) Commission proposed that the fisheries agreement between the Common Market and Iceland be effective as of 1 July 1976. The EC Council then approved the implementation of the protocol. It expired 1 December 1976. The fisheries agreement is part of the so-called "protocol 6" of the Free Trade Agreement between the EC and Iceland signed in 1972. Because of Iceland's unilateral extension of its fisheries jurisdiction, the agreement was never put into effect. This led to serious problems for Iceland's most important industry, as sales possibilities in markets such as the United States were adversely affected. After adoption of the protocol, it was expected that the duty level for Icelandic fish landed in EC ports would drop from 10-30 percent to 2-3.7 percent for certain species and 10 percent for canned goods. *Morgunbladid*, a Reykjavik newspaper, estimated that failure to implement the trade protocol cost the Icelandic fishing industry $2 million in 1974.

Implementation of the fisheries protocol with Iceland was expected to serve as an incentive for the EC to finalize its own common fisheries policy. Formerly, an individual EC member could block the adoption of the fisheries protocol, but consensus among the nine member states is now mandatory in order to suspend an agreement. Without a common EC fisheries policy, such a consensus will be difficult to obtain. (Sources: *Børsen* and *Morgunbladid.*)

Japan's Marine Biology Research Units Listed

A listing of 157 different marine biological institutes and laboratories in Japan, including institutes affiliated with universities, government-funded institutes, and private institutes, is available from the International Fisheries Analysis Branch (F411), National Marine Fisheries Service, NOAA, U.S. Department of Commerce, Washington, DC 20235. Please include a self-addressed mailing label if you would like a copy of the list.

Papua New Guinea Grabs Taiwanese Fishing Vessel

A Papua New Guinea (PNG) coastal patrol observed the Taiwanese fishing vessel *She Lon* on 17 July 1976, inside PNG territorial waters near Nuguria Island (see map on the next page). The vessel's master, Cheung To Ming, was charged with illegal entry into PNG territorial waters and with operation of a fishing vessel within PNG waters without having stowed and secured all fishing equipment. The vessel was seized and escorted to Simpson Harbor, Rabaul.

At the time of seizure the ship's radio officer, Wu Hong Ceng, posed as the captain, and the PNG enforcement officer, upon realization, charged the radio officer with perjury. The two men were arraigned in the Provincial Court at Rabaul. The captain and radio officer pleaded not guilty and throughout the proceedings stated that their vessel had been having engine trouble and had entered PNG's waters for shelter while undergoing repairs. The vessel broke down enroute to Port Moresby. The master and radio officer were both found guilty, fined US$619 and US$309 respectively, and the vessel was forfeited to PNG authorities. Although it is not certain what the PNG Government will do with the vessel, in the past confiscated vessels have been offered for sale to their owners.

The *She Lon* carries a crew of 18. At the time of seizure only the captain and two crew members were on board. The remaining 15 men were located on 18 July by a search patrol, on a small uninhabited island, not far from where the vessel had been intercepted. According to the *She Lon*'s master, the men had gone ashore in search of food while the ship was being repaired.

According to the NMFS Office of International Fisheries, PNG achieved its independence from Australia in September 1975. In November 1975, it concluded a fisheries agreement with Japan (see next article). Soon after, in December 1975, PNG seized, confiscated, and then released a Japanese vessel for violating PNG's 3-mile territorial waters.

In related incidents, the Australian Government has been seizing a large number of Taiwanese fishing vessels in

an effort to enforce its territorial waters. Between January 1975 and April 1976 about 32 Taiwanese vessels were either seized or detained by Australian authorities. Of these, 12 were confiscated by the Australian Government during the period from November 1975 through April 1976; four of these vessels had been sold back to their original owners, three were in the process of being readied for resale, one was of interest to both the Australian industry and its original owners, and four were undisposed of. (Source: U.S. Embassy, Port Moresby.)

Japan Assists Papau New Guinea Fisheries

Japan and Papua New Guinea signed a fisheries agreement in Port Moresby on 26 November 1975. Under its terms, Japan will give $2.2 million to finance a fisheries training center on New Ireland Island (see map). In return, Papua New Guinea agreed to permit Japanese longliners to fish for tuna in designated areas between 3 and 12 nautical miles off its coasts until 27 November 1976. Papua New Guinea allowed Japanese longliners port privileges at Rabaul, Madang, and Kavieng until the end of 1976 and port fees were increased nearly 500 percent to $675 per vessel.

According to the NMFS Office of International Fisheries, in 1968, Japan and Australia signed a 7-year fisheries agreement concerning the operation of Japanese tuna longliners in waters near Australia and allowed them port privileges at Brisbane, Freemantle, Hobart, and Sydney. At the time the agreement was signed, Papua was an Australian territory and New Guinea was a United Nations Trust Territory. Both were administered jointly by Australia and fishing in their waters fell under the general provisions of the agreement.

Papua New Guinea became an independent state on 16 September 1975, and thus negotiated the extension of the fisheries agreement as a sovereign nation. When Japan and Papua New Guinea signed their bilateral fisheries agreement in November 1975, its terms were similar to those of the preexisting Japan-Australia agreement. In a separate action, Australia and Japan also extended their bilateral agreement to 27 November 1976. Fishery resources of Papua New Guinea waters include shrimp and tuna, both available in commercial quantities, and such other marine products as shells and pearls. Papua New Guinea shrimp and tuna exports in 1970-71 amounted to $1.4 million (Table 1).

Tuna fishing in the Papua New Guinea area is conducted almost entirely by pole-and-line vessels using live bait. Between 1970 and 1973, there were 60 Japanese vessels, 2 Australian vessels, and 1 U.S. vessel in the tuna fishery. By November 1975, Japanese effort had grown to 100 vessels. Baitfish resource surveys have shown that *Stolephorus* anchovies are abundant, but that good baitfish grounds are limited. Anchovies and other baitfish are fragile and preventing high baitfish mortality has proved difficult. Baitfish operations are regulated to prevent overfishing by reserving areas for the exclusive use of one fishing company. Bait fishing is done with bright lights at night and tuna vessels generally restrict their operations to grounds within a 90-mile radius of the six bait fishing areas.

Private Japanese fishing companies have been operating in Papua New Guinea since 1967 when Nihon Kinkai Hogei Co. financed the South Sea Fishing Co. which began fishing for shrimp, tuna, barramundi, and other reef fish. In 1970, Kyokuyo and the Australia-based firm, Gollin Investment, Ltd., established the joint company, Gollin Kyokuyo, followed in 1971 by the joint ventures Kaigai Gyogyo-W.R. Carpenter (Carpenter Kaigai) and that of Hokoku Suisan-Nippon Suisan-C. Itoh Co. and an Australian firm (New Guinea Marine Products, Ltd.). In addition to Japanese joint ventures, the U.S. company Starkist established a Papua-based company in 1971.

In 1972, Kyokuyo began a tuna smoking/drying plant on Nago Island, and Kaigai Gyogyo began a skipjack processing plant at Kavieng. In 1974,

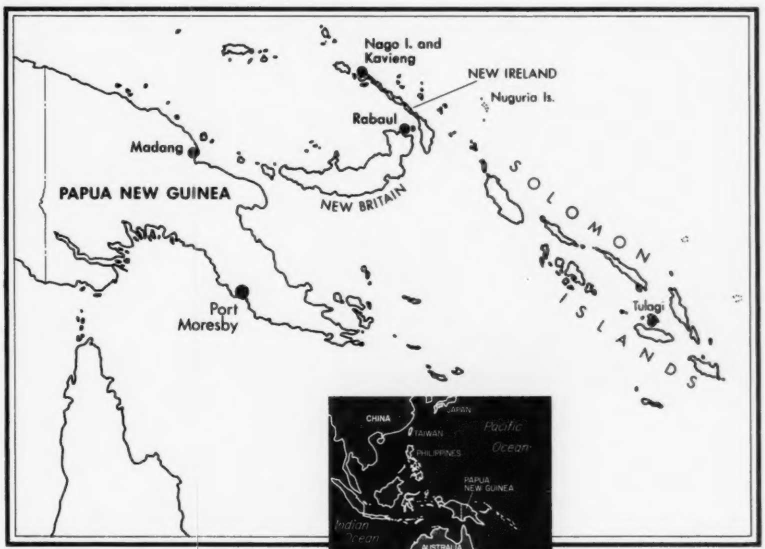


Table 1.—Value of Papua New Guinea's fishery exports, 1969-72.

Commodity	Value[1] 1969	1970	1971	1972
Fresh fish	85	245	1,992	4,227
Shrimp and lobster tails	380	935	1,242	2,910
Total	465	1,180	2,234	7,137

[1] Value given in US$1,000. Australian dollars are converted at the 1972 rate: A$0.7047 = US$1.00.

the Japanese and U.S. firms agreed to the formation of the Papua New Guinea Canning Company, to construct a cannery in Madang. The companies stated that 50 percent of the catch would be processed in Papua New Guinea and the rest exported frozen round by the end of 1977. Until completion of the cannery, all the catch is being exported frozen.

In recent years, skipjack catches have decreased. Hokoku Suisan terminated its Papua New Guinea skipjack fishery in August 1975, because of exceptionally low catches. For that year, it reported a total catch of 1,800 metric tons (t), more than 50 percent below the 1974 catch. Kaigai Gyogyo and Kyokuyo reported lower average June-July catches also: Kaigai Gyogyo's catch dropped from 1,313 t to 922 t (- 30 percent); Kyokuyo's from 2,066 t to 794 t (-62 percent). These declines may be due to the difficulty the Japanese have experienced in holding baitfish and in locating concentrations of skipjack in waters near Papua New Guinea.

While not directly involved in Papua New Guinea, Taiyo Gyogyo of Japan has been active in the nearby Soloman Islands. In 1972, Taiyo established a joint venture there and reported a June-August 1973 catch of 3,900 t. In 1974, a fleet of 10 pole-and-line vessels aimed at a catch of 10,000 t. Taiyo built an 800-t capacity cold storage at Tulagi in 1973 and also operates a tuna cannery there which can produce 1,300 standard cases a day. (Sources: Japanese press reports; *Fishing News International;* and *Marine Fisheries Review.*)

Sweden Hikes Fishing Industry Subsidies

Minister of Agriculture Svante Lundkvist announced on 15 August 1976 that the Swedish Government has decided to devote particular attention to the current problems of its fishermen. The Swedish Department of Agriculture has overall responsibility for fisheries. He said that a sum of 50 million kroner ($11.4 million) would be budgeted during the next 12-month period in support of the nation's approximately 5,000 professional fishermen. This money would be used primarily to support fish prices and to assist fishermen to increase their efficiency and competitiveness.

Lundkvist pointed to the mounting problems confronting Sweden's fishermen, particularly in the North Sea, where increasing use of larger and more efficient fishing vessels and improved catching methods and techniques are sharply reducing the fish population. This trend, he emphasized, is posing a threat to the very foundation of the fisheries industry. The future of the industry, he said, will depend largely upon whether all interested nations can cooperate and agree to protect fishery stocks and divide their fishing rights. Lundkvist stressed that the Government is doing everything possible to protect and safeguard the interests of Swedish fisheries, not least with regard to the matter of fishing limits.

The Minister of Agriculture, however, emphasized that the future of Sweden's fisheries must not be wholly reliant on how much support the Government can provide. The industry itself must review its organizational structure to ascertain what form could best further its interests and provide greater security for its employees. Lundkvist stressed the need to improve distribution and marketing techniques and stimulate consumer demand for fish. He urged fishermen to cooperate more closely with one another in their planning and promised that their trade organizations could, in that case, reckon with the Government's support.

Lundkvist did not detail the measures which the Government would take in support of the industry. It is likely that they will, among other things, include grants to fishermen for purchasing better vessels and nets, minimum price guarantees and other forms of price support, purchases of surplus catches, and loans at favorable terms. (Source: U.S. Embassy, Stockholm.)

Approximately $4 million was allocated to the fishing industry for price supports, unemployment compensation, and vessel subsidies in the 1976 Swedish budget. This allocation represents a substantial increase in Government subsidies which were only approximately $2 million in 1975. (Source: *Peche Maritime.*)

HALIBUT VIOLATION SNAGS JAPANESE STERN TRAWLER

The U.S. Coast Guard Cutter *Confidence* observed the Japanese stern trawler *Tomi Maru No. 85* (499 GRT) fishing off Cape Yakataga, Alaska, on 25 August 1976. Noting the steep angle of the trawl lines, the *Confidence* sent a boarding party to inspect the Japanese vessel's catch for possible retention of crabs or for other violations of U.S. laws regarding Continental Shelf Fisheries Resources (CSFR).

Inspection of the freezer holds of the *Tomi Maru No. 85* revealed halibut, a possible violation of the 1952 International Convention for the High Seas Fisheries of the North Pacific Ocean (INPFC). Under the terms of this Convention, Japan agreed to abstain from halibut and salmon fishing east of long. 175° W.

ESCORTED TO KODIAK

The *Confidence* escorted the *Tomi Maru No. 85* to Kodiak when the U.S. vessel was unable to establish contact with a Japanese Fisheries Agency (JFA) patrol vessel at sea. In Kodiak, National Marine Fisheries Service Enforcement Agents sampled the catch in the freezer holds of the Japanese vessel and discovered some 60 halibut, weighing an average of 40 pounds each. The halibut were stored in holds with the rest of the catch, approximately 200 metric tons of red rockfish. Although no crab or other CSFR was discovered, NMFS agents found a sea lion head.

On 30 August 1976, the *Confidence* escorted the *Tomi Maru No. 85* to a rendezvous with the JFA patrol vessel *Konan Maru No. 20.* The JFA will investigate the circumstances of the

apparent halibut violation and the Government of Japan will fine the vessel's owner if the charges are substantiated.

The 197-foot long *Tomi Maru No. 85* is a modern 499 GRT stern trawler built in 1972 and owned by the Kanai Fisheries Co., Ltd., of Nemuro, Japan. Detention of this vessel brings to nine the number of enforcement incidents involving fishing vessels of Japan off U.S. coasts in 1976, according to the NMFS Office of International Fisheries.

OTHER VIOLATIONS

In March 1976, the *Eikyu Maru No. 81* was seized for violating the U.S. Contiguous Fishing Zone (CFZ) off Alaska and fined $580,000. In April, the *Kohoku Maru No. 12* was seized off Alaska for retaining CSFR and fined $700,000. In July, the *Okuni Maru* was seized off the New Jersey coast for a CSFR violation and fined $200,000. In the same month, the *Yamasan Maru No. 85* was seized off Alaska for violating the U.S. CFZ and fined $625,000.

The other detentions of Japanese vessels took place in July 1976 when four Japanese salmon gillnet vessels were transferred to the custody of JFA patrol vessels for fishing salmon east of long. 175° W an INPFC violation. (Source: National Marine Fisheries Service, Law Enforcement and Surveillance Division.)

Peru Issues Ultimatum To Anchovy Fishermen

Peruvian anchoveta fishermen were scheduled to begin the second phase of the 1976 fishing season on 18 October. The Peruvian Government fishing company, PESCAPERU, estimates that up to 1 million metric tons (t) of anchoveta could have been obtained by the end of the year, bringing the total 1976 anchovy catch to above 4 million t, or over 0.5 million t more than was caught in 1975.

According to the Peruvian Government, however, the Fishermen's Federation (formerly the bulwark of the Government's own trade union, the CTRP) pressured its affiliated unions and fishermen to stay in port. The Government further charged that the Fishermen's federation has threatened new owners of fishing boats and individual fishermen, forcing them also to stay in port. The Fishermen's Federation had opposed PESCAPERU's recent sale of its fishing fleet as well as a projected personal cutback affecting many fishermen who have been on the PESCAPERU payroll.

Faced with what the Government considers Federation intransigence amounting to a sabotage of production, the Fisheries Ministry issued a communique on 18 October giving fishermen 48 hours to put their boats to sea or be summarily fired by PESCAPERU.

FISHING VESSEL SEIZURES NOTED

Listed below are some of the more important fishing vessel seizures as of September 1976, and related incidents. These incidents are a demonstration of international tensions in coastal areas and of the increasing competition for fisheries resources and have been compiled by the NMFS Office of International Fisheries.

SEIZURES BY THE UNITED STATES

The Japanese stern trawler *Eikyu Maru No. 81*, seized 31 March for a Contiguous Fishing Zone (CFZ) violation off Alaska, was fined $580,000 on 12 April. Another Japanese stern trawler, *Kohoku Maru No. 12*, (349 tons) was seized on 14 April off Semispochnoi Island, Alaska. On inspection, 30 pounds of frozen processed king crab and 7 whole female crabs were found. The vessel is owned by the Hokkaido Gyogyo Kosha of Sapporo, Japan. The owners paid a penalty of $700,000 for the Continental Shelf Fisheries Resource (CSFR) violation. The U.S. Coast Guard took custody of the vessel after the CSFR case was settled, because of violations of International North Pacific Fisheries Com-Commission (INPFC) regulations. After case documentation, the vessel was released from U.S. custody 28 May.

The Spanish fishing vessel *Anna Maria Gandon* was seized 26 miles off the U.S. coast for a CSFR violation on 5 April. The vessel was fined $100,000 and released 19 April.

The Japanese stern trawler *Yamasan Maru No. 85* was released from U.S. Coast Guard custody on 24 July after its owners paid a fine of $625,000 for a 10 July CFZ violation near Amlia Island, Alaska.

The Korean stern trawler *Kyung Yang Ho* (5,377 GRT) was seized 30 miles south of Unimak Pass, Alaska, on 21 July. King crab, halibut, and marine mammals were found on board in violation of U.S. laws and bilateral agreement. The vessel departed U.S. waters on 21 August after paying a fine of $575,000. Three Japanese land-based gillnet vessels were detained during July 1976 by the U.S. Coast Guard for suspected violations of the INPFC Convention which prohibits salmon fishing east of long. 175° W.

The Korean longliner *Dong Won 707* (620 tons) was seized off Baranof Island, Alaska, for a CSFR violation on 1 August. King and golden king crabs were found when the vessel was inspected by NMFS enforcement agents. The Italian vessel *Amoruso Quarto*, seized by U.S. authorities on 21 July for a CSFR violation, was fined $100,000 and released from custody on 4 August and the Japanese stern trawler *Ookuni Maru*, seized off New Jersey on 28 July for a CSFR violation, was fined $200,000 and released on 3 August.

A Mexican shrimp trawler, the *Casitas I*, was seized by the U.S. Customs Bureau for a territorial sea violation off Texas on 20 July. Criminal and civil charges were dropped by the Assistant U.S. Attorney in Houston, Tex., and the vessel was released. The owner of the vessel was reimbursed $1,740 for the value of the shrimp which had been impounded and sold at public auction.

The Greek side trawler *Atlanticos II*, seized on 18 June by the U.S. Coast Guard and the National Marine Fisheries Service for a CSFR violation, was fined $115,000 and released on 18 August. The captain was also fined $115,000 and given a 2-year suspended sentence.

The Canadian halibut longliner *Alaska Queen II*, seized by U.S. authorities on 6 August for a territorial sea violation, was released from custody on 9 August. The catch of 16,500 kg, valued at $46,000 was seized, and the master and crew were fined $33,750. which was suspended.

Two Canadian purse seiners, seized by U.S. authorities on 18 August for violation of U.S. territorial waters, were fined and released on 20 August. The *Sea Luck* was fined $1,500 and the *Attu*, whose master was described as uncooperative at the time of arrest, was fined $2,000.

The Japanese stern trawler *Tomi Maru No. 85* was boarded on 26 August off Cape Yakataga, Alaska. An inspection discovered 60 halibut, aviolation of the INPFC Convention. The 499-gross ton Japanese vessel was escorted to Kodiak by the U.S. Coast Guard Cutter *Confidence*, then released into the custody of a Japanese Fisheries Agency patrol vessel.

The Republic of Korea longliner *Kwang Myong No. 21* (500 GRT) was seized 3 September south of Cape Spencer, Alaska, for retaining Continental Shelf fishery resources. The vessel is registered in Panama, but is owned by the Korea Wonyang Company.

The Republic of Korea stern trawler *Kum Kang San* (740 GRT) and the ROK cargo vessel *Chilbosan No. 5* (1,651 GRT) were detained after being observed inside the U.S. Contiguous Fishing Zone off Rootok Island, Alaska, on 13 September. The two vessels were released with a strong warning.

SEIZURES OF U.S. VESSELS

Two U.S. fishing vessels, *Donna B* and *Roberta Jean*, were seized by Mexico on 17 June for fishing in Turtle Bay, a "restricted" area along Mexico's Pacific coast. Although both vessels had valid Mexican fishing licenses they were assessed fines of $800 each. The U.S. shrimp vessel, *Shiloh*, was seized on 17 June for fishing in Mexican-claimed waters in the Gulf of Mexico. And, the U.S. fishing vessel, *El Lobo*, a San Diego-based 50-foot charter boat, was seized by Mexico for fishing albacore in Mexican-claimed waters without a license.

OTHER SEIZURES

Sri Lanka seized 38 Indian fishing vessels in February during its assault on poachers inside its 12-mile fishery zone. The boats were held for 48 hours and released. Egypt seized four Greek trawlers in March and April. Greece has claimed that they were more than 14 miles off the Egyptian coast. There are also three Greek trawlers still in the custody of Libyan authorities.

The Romanian vessel *Negoia*, seized on 25 May for illegal fishing off the coast of Ireland, has been released. Its captain was fined $270 and his gear, valued at $70,000, was confiscated. British authorities seized 11 Dominican fishermen in June for fishing illegally in the waters off Turks Island.

Mexico reported on 30 June that five Cuban shrimp trawlers had been seized for fishing in Mexican waters off Campeche state. The vessels were released after paying fines.

The *Song Sung No. 12*, a 100-ton South Korean trawler, was seized by

French Fishery Product Imports Rise in '75

French imports of fishery products continued to increase in 1975. Preliminary statistics indicate that 309,800 metric tons (t) of fishery products valued at US$444 million were imported in 1975 compared to 297,864 t valued at US$410.9 million in 1974. French fisheries exports in 1975 were US$98 million, resulting in a trade imbalance of US$346 million. The deficit was US$325 million in 1974.

The trade balance of fishery products is shown in Table 1 and imports, by species, are shown in Table 2.

Table 1.—French fish product imports, exports, and trade balance by quantity (in metric tons) and value (in million US$), 1975. (Source: *Peche Maritime*.)

	Quantity			Value		
Product	Imports	Exports	Balance	Imports	Exports	Balance
Fish						
Fresh and frozen	161,349	44,793	−116,556	$193	$46	−$147
Salted, dried, and smoked	12,286	4,644	− 7,642	16	8	− 8
Canned	43,349	3,387	− 39,962	77	6	− 71
Total	216,984	52,824	−164,160	286	$60	−226
Shellfish						
Fresh and frozen						
Crustaceans	18,764	3,361	− 15,403	72	10	− 62
Mollusks	62,758	12,719	− 50,039	51	16	− 35
Canned	11,294	1,875	− 9,419	35	12	− 23
Total	92,816	17,955	− 74,861	158	38	− 120
Grand total	309,800	70,779	−239,021	$444	$98	−$346

Table 2.—French imports of principal species of fish by quantity (in metric tons) and average price (francs/kg at US$1.00 = 4.4 French francs), 1974-75. (Source: *Peche Maritime*.)

	Quantity		Average price	
Species	1975	1974	1975	1974
Fish, fresh				
Anchovy	845	275	1.66	—
Blackfish	1,756	1,511	3.84	3.12
Cod	21,972	21,795	4.09	4.67
Cod fillets	3,142	2,784	7.18	7.58
Dogfish	3,827	3,077	4.39	4.78
Herring	7,755	7,297	2.28	1.81
Mackerel	10,058	5,119	0.78	1.04
Sardine	8,662	11,052	2.04	1.74
Sole	5,991	5,546	20.86	18.94
White tuna	1,053	3,744	—	6.36
Whiting	2,622	2,387	2.37	2.98
Fish, frozen				
Anchovy	90	157	1.30	—
Blackfish fillets	2,331	665	4.75	3.97
Cod fillets	5,249	4,913	4.72	6.07
Haddock	398	580	4.56	—
Herring	5,338	4,514	2.50	2.39

	Quantity		Average price	
Species	1975	1974	1975	1974
Mackerel	7,954	6,639	1.00	1.39
Salmon	13,693	9,491	18.79	15.55
Sardine	14,368	17,100	1.44	1.56
Fish, cured or salted				
Anchovy	1,548	3,743	3.64	3.39
Cod, salted	3,455	3,163	4.12	7.23
Cod, dried	2,752	2,247	9.08	10.99
Herring	3,125	3,029	2.36	2.17
Shellfish				
Whole lobster	694	622	37.63	33.48
Lobster tails	1,043	561	47.43	40.16
Spiny lobster	868	860	25.65	26.80
Mussels	40,369	34,378	1.12	1.11
Gray shrimp	2,987	3,113	7.34	12.41
Other shrimp	9,926	7,443	14.27	16.54
Squid	5,357	5,416	5.67	5.83

Japan on 26 June for operating inside the 3-mile territorial waters off Tsushima Island in southern Japan. The Soviet Union seized 13 Japanese fishing vessels in the disputed Northern Territories area between 1 January and 30 June 1976.

Indonesia seized two Taiwanese fishing vessels on 2 February. The *Lita I* and *Lita II* were charged with poaching in the Strait of Malacca. Both vessels (480 tons each) and their 35-men crews were detained in Belawan, Sumatra, by the Indonesian Navy.

Sri Lanka seized a Taiwanese fishing vessel for fishing inside territorial waters on 3 February. The 200-ton vessel was held in Trincomalee until the case was settled.

Bulgaria has seized 8 Turkish fishing vessels with crews totaling 55 persons. Bulgaria claimed that the Turkish fishermen strayed into Bulgarian waters on 6 February. Bulgaria claims a 12-mile territorial sea.

Irish authorities seized a Belgian trawler during the first week in March for fishing within Ireland's 12-mile territorial waters. The skipper of the vessel was fined and his gear and catch, valued at $8,000, were seized.

Australia seized two Taiwanese fishing vessels, the *Chiau Chang No. 11* on4 March off the Gilbert River, and the *Hsieh Shin No. 21* on 9 March, at the western approaches to Torres Strait. Both vessels were inside Australia's declared fishing zone. On 10 March the two vessels were forfeited. This brought the total number of Taiwanese fishing vessels forfeited to Australia since November 1975 to 12.

The Soviet Union seized two Japanese sea urchin fishing vessels on 18 March while they were operating in waters off Kunashiri Island. This incident was the first 1976 seizure in the disputed northern waters.

Canadian authorities seized the Japanese fishing vessel *Shizuoka Maru* on 30 March for violation of its fishery closing lines, which have been claimed since 1970. A U.S. fishery observer was aboard the vessel when it was seized.

New Zealand seized a Taiwanese vessel on 30 March for fishing inside its territorial waters. The Taiwanese vessel was escorted to New Plymouth where it was held pending disposition of the case.

Moroccan authorities seized 4 Spanish fishing vessels on 31 March while fishing off northwest Africa. The vessels were taken to Casablanca.

Norwegian authorities seized two Spanish trawlers on 6 April, for violation of fishery zones. The vessels were released after posting a $20,000 bond, but were brought back into port after it was determined that they may have destroyed fishing nets in a Norwegian trawl-free zone earlier this year.

The Indian Navy seized two Taiwanese trawlers on 22 April, about 55 miles north of Madras. And Ireland seized two Spanish vessels in early May for fishing within Irish territorial waters. The ships' captains were each fined $200 and forfeited $30,000 worth of gear and equipment.

Malaysia seized 4 Thai fishing trawlers on 12 May for fishing illegally in Malaysian-claimed waters. The catches were confiscated and sold at auction.

A Venezuelan helicopter fired on 15 Trinidadian fishing vessels operating in Venezuelan-claimed waters on 14 May. Trinidadian fishermen complain that Venezuelan trawlers also operate in

Netherlands' 1975 Fish Landings Increase

Total 1975 Dutch fishery landings were 309,908 metric tons (t) compared to 293,925 t in 1974, according to the Netherlands Central Bureau of Statistics. There were sizeable increases over 1974 in both herring and shellfish landings (see table). The total value of all Dutch landings was 468,559,000 Dutch guilders in 1975 compared to 421,427,000 guilders in 1974.

Imports in 1975 totaled 165,118 t, an increase of 26,453 t over 1974. Fishmeal was the largest commodity imported, followed by fresh and frozen herring. Exports for 1975 totaled 196,195 t compared to 189,534 t in 1974.

Total Dutch fish landings (in metric tons) by species for 1975 and 1974.

	1975		1974	
	Landings	Value[1]	Landings	Value
Fish				
Cod	18,474	31,314	19,358	39,384
Haddock	1,821	2,310	2,546	3,660
Coley	5,005	4,745	8,614	9,269
Whiting	9,839	10,586	10,037	11,115
Plaice	44,411	72,119	48,472	76,284
Dover sole	13,977	127,829	14,116	116,035
Turbot	3,022	20,355	2,588	15,818
Herring, fresh	25,953	27,711	24,218	20,492
Herring, salted	33,441	57,659	24,948	47,516
Sprat	2,086	1,727	1,014	468
Mackerel	11,749	10,749	9,220	6,131
Total, fish	169,778	367,104	165,131	346,172
Shellfish				
Mussels	97,501	28,466	85,842	19,979
Oysters	1,381	12,979	1,204	10,307
Shrimp	6,098	24,524	6,084	19,187
Other shellfish	149	203	159	200
Total, shellfish	105,129	66,172	93,289	49,673
Fish for reduction	21,082	7,990	21,999	4,104
Other[2]	13,919	27,293	14,306	21,478
Grand total	309,908	468,559	293,925	421,427

[1] Value listed in 1,000 guilders at US$1.00 = 2.678 Dutch guilders.
[2] Includes freshwater landings and landings of minor species.
Source: Netherlands. Central Bureau of Statistics. *Maandcijfers van de visserij, January 1976.*

Trinidadian waters.

A British trawler was seized on 15 May by a Danish inspection vessel for fishing within the 12-mile limit of the Faeroe Islands. The vessel was fined $10,000 and its gear and catch were confiscated.

A Romanian trawler was seized in Ireland's 12-mile territorial sea on 25 May and charged with illegal fishing. The 273-foot stern factory trawler *Negoia* had 27 metric tons of fish on board.

Indonesia reported seizing the Taiwanese trawler *Wan Cheng Shiang* on 3 June for fishing in North Sulawesi waters without a permit. The vessel was towed to Tahuna port for further investigation.

The Spanish fishing vessel *Caridad* was boarded by a Moroccan patrol on 4 June. Members of the patrol vessel searched the Spanish ship and confiscated 300 kg of fish. The ship was then released.

Spain seized four Portuguese fishing vessels near Cadiz on 11 June, for fishing within Spanish waters. Their catches were confiscated and auctioned.

The People's Republic of China (PRC) seized two Republic of Korea (ROK) fishing vessels in separate incidents on 11 and 13 June. While the PRC has protested numerous violations of its "territorial waters" by ROK vessels since April, the ROK insisted that its vessels were operating on "the high seas" and demanded the immediate release of the vessels and crews. The ROK stated its willingness to negotiate with the PRC, despite the lack of bilateral diplomatic relations, and to conclude a fishing agreement relating to operations in the East China Sea. The PRC released both vessels during the week of 21 June.

Ireland seized two trawlers, one British and one French, in the first week of July for fishing inside Irish territorial waters. Both captains were fined and had their gear and catch confiscated.

The Soviet Union seized the Japanese fishing vessel *Koei Maru No. 8* (28 GRT) on 20 July for violating Soviet-claimed waters off Kunashir Island. The vessel, the nineteenth detained by Soviet authorities in 1976, was released 25 July.

A Vietnamese patrol vessel attacked and sank two Thai fishing trawlers on 13 August, about 20 miles off Pulowai Island. Some 32 crewmen were reported dead or missing.

The Soviet Union seized three Japanese fishing vessels in the disputed waters north of the Japanese island of Hokkaido, taking the *Hakuyo Maru No. 5*, the *Chosei Maru*, and the *Koryu Maru No. 22* last summer. While in Soviet custody, the master of the *Hakuyo Maru No. 5* committed suicide and Japanese authorities have requested details from the Soviet Government. Another vessel, the *Chiyo Maru No. 2*, (99 GRT) was seized 25 August.

The United Kingdom seized the Soviet trawler *Arinas* in July, 10 miles off the British coast for a violation of fishing limits. The captain of the vessel was fined $360 and his catch was confiscated.

A Malaysian Navy patrol craft apprehended a foreign trawler in Malaysian waters 10 miles north of Mukah off the coast of Sarawak on 17 July. Malaysia said the trawler was towed to Sibu and handed over to the police. Two other trawlers were also reported in the area, but they were outside Malaysian waters.

An Ethiopian gunboat reportedly entered territorial waters of the Yemen Arab Republic on 18 August and arrested three Yemeni fishermen. The incident took place between Hanish Island and Port Al-Mukha.

Australia seized a 285 GRT Japanese trawler for fishing inside the 12-mile fishery limit lines off the east coast during the week of 23 August, fined its master $1,000 (US$1,237), then released the vessel. This was Australia's first seizure of a Japanese vessel, although between January 1975 and April 1976, 32 Taiwanese fishing vessels were either seized or detained.

North Korea seized a South Korean squid vessel and its crew on 30 August. The South Korean vessel crossed into North Korean waters, just above the Military Demarcation Line apparently because of heavy fog. Attempts to contact Red Cross officials in North Korea were futile because phone lines linking the two Koreas had been cut in the wake of incidents in Panmunjom.

U.S.-Polish Fisheries Conciliation Board Acts

The U.S.-Polish Fisheries Conciliation Board was established by executive agreement, signed in Warsaw on 2 June 1973, and began to function in New York in May 1975. The Board was created to facilitate the settlement of claims resulting from damage or loss to the fishing vessels or fishing gear belonging to nationals of either State. Although the inital agreement specified that the Board would operate for 2 years after the signing date, the Board has continued to function through two extensions in May 1975 and May 1976.

The four members of the Board are appointed by their respective governments, but they actually operate as independent judges of the facts placed before them. In settling claims, the Board examines evidence submitted by fishermen of both countries and determines whether it is sufficient to make recommendations as to who is responsible for the damages incurred.

By November 1976, the Board had examined eight allegations of loss or damage to American fishing vessels or gear by Polish vessels. The Board made recommendations in six of these cases, four of which were favorable to the U.S. claimants for a total of $10,500. In two claims the Board found that the evidence submitted was insufficient to establish the responsibility of Polish vessels for the damages incurred. The Board was unable to consider two other claims since the incidents occurred prior to the period which the Board may consider. (Source: *Report of the U.S.-Polish Fisheries Conciliation Board*, 1976.)

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